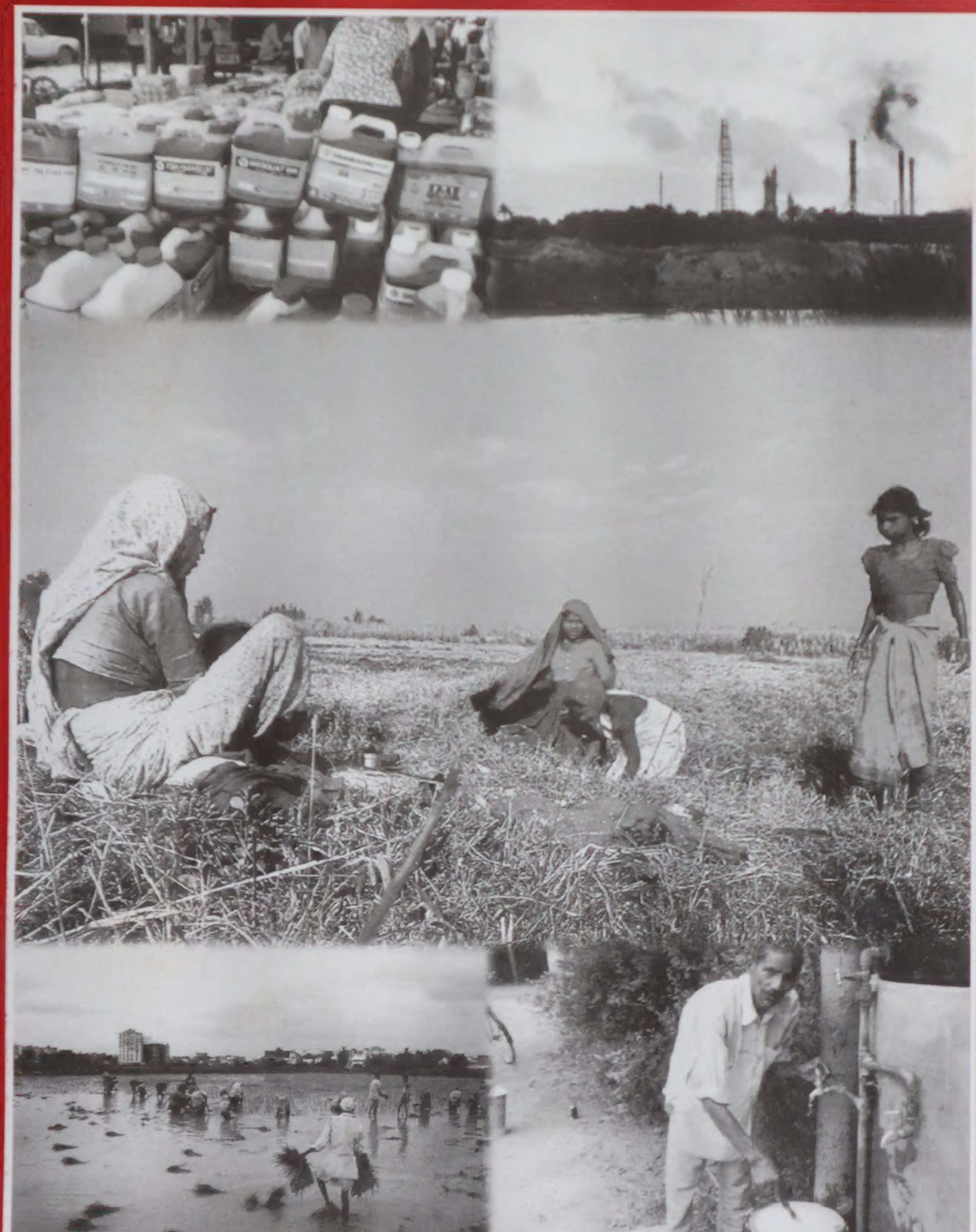
100/-

TROJAN HORSES

Persistent Organic Pollutants in India



A Srishti - TOXICS LINK Report

NOVEMBER 2000

This report has been jointly prepared by TOXICS LINK member organisation Srishti for and along with TOXICS LINK, which worked on it on a voluntary basis. The report will be distributed and propagated through the toxics link information exchange network.

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About SRISHTI

Srishti is a non profit environmental organisation, involved in the issue of medical and municipal wastes. It is also part of the NGO Forum for the NCR working on the environmental issues of Delhi.

Other Srishti reports, published and forthcoming:

- Be careful with that cure: A critical look at medical waste incineration. 1996.
- Implementing Hospital Waste Management: A guide for healthcare facilities. 1997
- Medical Waste: Issues and practices and policies. 1998
- A compilation of factsheet on incineration, Mercury, Sharps, plastics in health care, economics of hospital waste management systems. (forthcoming)

About TOXICS LINK

TOXICS LINK is a non profit environmental organisation working towards freedom from toxic pollution. Operating since 1996, Toxics Link has three information outreach nodes in Delhi, Mumbai and Chennai respectively. The nodes provide information to grassroots groups and individuals and networks with others working on environmental toxicity issues.

Other Toxics Link reports, published and forthcoming:

- Not so inert after all! Flyash: an environmental and health perspective. 1997
- Landfills Deconstructed: Technology, Management and Experiences. 1998
- Status of Hazardous Wastes in India. 1999
- Cloning Bhopal: Exposing the dangers in Delhi's environment. 1999
- Pesticides in India: Environment and health sourcebook. 2000
- Common Effluent Treatment plants: Technology, Management and Experiences. (forthcoming)

TOXICS LINK *information exchange*

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Preface

The last century can easily be called the era of chemicals. More than 18 million chemicals were synthesized during this time and about a hundred thousand of them came into commercial use. Unfortunately, not all of them were safe from an environment and human health standpoint. The effects of only a handful, less than a few thousand, of these are known, and that too partially.

Of the thousand odd chemicals recognized as harmful, more than 50 per cent are based on the element chlorine. In 1995 the United Nations Environmental Program (UNEP) decided to eliminate twelve such chemicals, all organochlorines, from world chemistry. These twelve were classified as POPs or persistent organic pollutants owing to their similar toxicity behavior. Of the list, nine were pesticides and fungicides, and one was polychlorinated biphenyl (PCB), used as a dielectric for electrical equipment. The last two, are dioxins and furnas, unintentionally produced as by-products of processes such as the manufacture of paper and pulp, and the incineration of waste, particularly medical waste, containing plastics like polyvinyl chloride (PVC).

POPs have particularly pernicious toxic qualities. For one, they volatilize and transport over long distances. Hence POPs produced near the equator have found their way into people living in the Arctic Circle. For example though PCB were never produced in Alaska, the Inuit people carry some of the highest levels of this contaminant. Secondly, POPs are fat soluble or lipophilic, and most of the contamination is through the consumption of fatty food, such as fish and marine animals. They are also bio accumulative and bio magnified. Hence a POP deposited on grass would appear in cow's milk, or through algae in the water in seals, accumulating and increasing in quantity (magnifying) as it went up the food chain. But, most frighteningly, POPs persist in our bodies as well as in the environment, without breaking down for very long times. So though DDT was banned in the USA more than a quarter century ago, it still 'persists' in the sediments of it Great Lakes, reducing fertility in Bald Eagles feeding off fish there.

POPS have health effects, which were hitherto not recognized. Over 90 per cent of POPs intake is through food. POPs have intergenerational effects, mostly passed on through mother's breast milk. In the first few months of an infant's life a feeding mother could pass on the entire lifetime load of the allowed body burden of a full grown adult. A growing infant, with a high hormonal activity, would suffer effects related to endocrine disruption, which would manifest only at puberty as sexual dysfunction, cryptorchidism (undescended testicles), hypospadis (abnormal utherral opening) slowed intellectual development, slower cognitive and physical growth, and reduced immunological functions.

Breast-fed babies in India and Zimbabwe absorb DDT products six times the acceptable daily intake levels, and Americans can receive upto twelve times their lifetime exposures to dioxin in the first six months. High levels of DDT have led to egg shell thinning of eagles in India, and a reported reduction in population of the majestic Sarus Cranes which forages in pesticides laden agricultural fields. The tragic effects of Agent Orange, a dioxin laden herbicide, liberally arially sprayed over Vietnam by the US Army is showing up not only in Vietnam US Army veterans but also in third generation Vietnamese children, never directly exposed to the chemical.

We as a race have been very slow to learn. It was as early as 1962 that Rachel Carson in her now legendary book 'Silent Spring' warned us about DDT, a wonder pesticide then widely used for agricultural as well as vector control of killer disease like malaria. Today it has demonstrated health effects. PCBs were invented as perfect dialectics for transformers, but now known to destroy life. Chemicals such as aldrin and dieldrin used for termite control or chlordane a broad-spectrum insecticide once widely used but are now banned less then three decades after they were marketed. All such chemicals were meant to be quick fixes to our problems, but turned out to be Trojan horses. It seems that the manner in which chemicals were introduced for use, assumed safe till proven otherwise, an approach which turns the 'precautionary principle' on its head, is the root of the problem. At are base lies a collusion of State and market driven industrial interests, which allowed us to progress in this manner.

The politics of chemical usage cannot be ignored. The case of DDT is one such example. Malaria has clearly not been a developed world's headache and research in its alternatives has not been adequately invested in. The killer tropical diseases account for 10 million cases annually with a 10 percent fatality. India alone has over 2.5 million malaria cases annually with more than 500 deaths each day. Only now has the Bill Gates foundation donated over 50 million USD for research of a malarial vaccine, a dream held for very long by one third of the world's population but never delivered. Meanwhile, the use of DDT, the chemical of choice for malarial control as per the WHO is becoming increasingly less effective as the mosquito become resistant to the chemical. In fact in a few years DDT may as well be useless for malaria control, and has led to WHO initiating the 'Roll Back Malaria Program' to shift strategies from DDT usage to broader approaches such as impregnated bed nets, environmental control and use of mosquito larvae eating fish. Till then DDT continues to be used in over 22 tropical countries of the world, mostly in Africa, besides India, China, South East Asia and Mexico, poisoning its people through medium and long term effects.

The complexities of eliminating POPs are currently being reflected in the negotiations taking place between 118 nations in the UNEP POPs' convention. The goal is an international, legally binding multilateral treaty, with an immediate objective to eradicate the 12 identified POPs and develop criterion for introducing new ones for future action. Developing countries,

who have come to depend on some of these chemicals are looking to the developed nations for financial and technical assistance. Take for example dioxins and furans, two POPs that are produced as by- products of chlorine based chemistry, and mostly from waste incineration. While developed countries have either moved rapidly to alternative technologies of waste disposal, or have extremely expensive means for controlling dioxin releases, their incinerator industry, under severe pressure from local community groups, are finding new markets for these obsolete technologies in unsuspecting and unaware developing countries. They would like the same mistakes to be made all over again here, and unless there is open sharing of new processes and techniques, the cost will once again have to be borne by the poorer populations of the world.

However, leap frogging into currently available technological fixes requires not only the co-operation of developed countries but also conscious policy initiatives from the recipient countries to ensure that this becomes an important pre-requisite for safer and sustainable development.

India has as yet to recognise its responsibility towards it environmental and citizen's health. DDT level in mother's breast milk here are amongst the highest in the world, with the capital city of Delhi topping the list. PCBs are not even regulated with the government denying even the possibility of their existence here, unable to explain high levels found in soil sediments in the river Yamuna. Hexachlorobenzene, (one of the 12 POPs) has never been manufactured in India, yet food tested in North India has been found laden with very high levels, probably a by-product of chloroform production.

Dioxins and furnas have never been measured, yet there is a massive government supported program of the Ministry of Non-Conventional Energy Sources to provide subsidies for waste incineration, one of the largest sources of dioxin and furan production world-wide. DDT has been banned for agricultural use, yet it is reportedly used widely by farmers. The existence of stockpiles of obsolete POPs is continuously denied, yet there have been recorded and reported widely. India remains one of the two counties, besides China, to manufacture DDT, and promote its use, even though its effectiveness will not be more than a few years with growing resistance to the chemical.

The answer lies in a more informed and aware citizenry to counter a State that believes in denial and ineffective regulation, along with an industry that remains unmoved towards its social responsibility.

Ravi Agarwal
TOXICS LINK

Introduction

POPs Treaty and its significance for India

For a developing country such as India the POPs treaty offers a unique opportunity to leapfrog into cleaner development paradigms without passing through the painful processes which developed countries have followed. The POPs treaty is an outcome of the realization that many chemicals being produced today are unsafe for use, and that their benefits may far outweigh the problems they cause. In fact by not actively negotiating a treaty, which is beneficial to her, India may find itself in a position of disadvantage and isolation

India today has the twelfth largest chemical industry in the world. However the boast ends there. It is also one of the most polluting and low-tech chemical industries. It has managed to render, in twenty-five short years expanses of fertile land unfit for any use and unredeemable. The industry continues to produce chemicals, which are untested, and being phased out in the rest of the world. It is a scattered industry with a large component in the small-scale sector. India also have large unaccounted stockpiles of obsolete chemicals, lying in godowns and shanties across the country, leaking their toxic brews into land and water. Though India claims never to have manufactured or used the deadly polychlorinated byphenyls (PCBs), its riverbeds are still contaminated by it as recent studies show. India continues to be the repository of toxic waste despite being party of an international convention and under the vigilant eye of the judiciary and NGOs.

In no way can India control this through end-of-the-pipe methods. The regulatory mechanisms are weak, and even if they were not so they would have to possess a gigantic infrastructure to deal with the problem. Can India afford to continue to poison its land and its people through such negligence? Must it be driven by pollution control regimes, which have failed to protect people even in countries they developed in?

It is time to make choices, and the POPs treaty offers an opportunity to help resource those choices provided India makes them and demands from the international community those resources which will be needed to follow such choices through, to establish a cleaner preventive route for its chemical development.

The key issues in the POPs treaty are three, besides others. The need to adopt a precautionary principle especially in the question of new chemicals, the goal of elimination, and the need to have adequate funding mechanism to ensure resources both financial as well as non-financial, be made accessible to developing countries and countries with economies in transition.

Though India has already banned 8 of the 12 POPs, and Dieldrin is slated for a ban immediately, their monitoring needs strengthening. India is one of the two DDT producers in the world besides China. Already there are in place various initiatives relating to integrated vector management. DDT has been banned for agricultural use since 1989. India is moving towards a policy to phase out DDT by the year 2003 or so, but these need replacement strategies, and a firm commitment to do so by supporting specific exemptions for this.

In the case of dioxins and furans India has no inventory (like any other developing country) but has many sources. One of the biggest threats are incinerators, both municipal as well as medical, which are being pushed by vested interests. On the other hand various policy groups have expressed that composting and bio-methanation technologies are more suited to Indian garbage, though one arm of the governmnt, The Ministry of Non-Conventional Energy Sources, which is focused on energy production is subsidizing various waste-to-energy technologies, amongst them incineration, pyrolosis and gasification. Law in India bans PVC incineration.

India by promoting the elimination route and commitment can easily adopt preventive approaches, both in term of technologies as well as products. Dioxin regulation is an extremely expensive option for India, and by investing in it investments in more conventional pollutants will be given the go bye. Again a firm elimination support will help it get commitment and a way to cleaner development.

India can also promote safer and non-POPs producing technologies by becoming a center for clean destruction technologies for the region, and by promoting such technologies and processes which are not focused on incineration.

India can ensure its development process be a 'clean' development one to ensuring that growth is not whittled away through environmental and health degradation.

Chapter 1

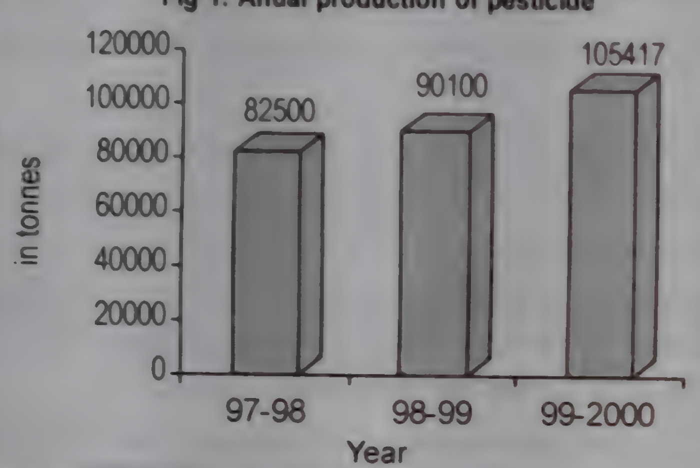
Shooting from the hip

Pesticide policy, manufacture and use

India is one of the leading pesticide manufacturers in Asia with an installed capacity of 1,62,757 tonnes annually. The annual production of pesticides in 1997-98 was 82,500 tonnes and in 1998-99 it was 90,100 tones, that is almost 8.4 per cent increase in the production. It is anticipated that there will be a 17 per cent increase in the production of pesticides in the year 1999-2000, that is approximately 1,05,417 tones. Currently there are 147 pesticides registered in the country for manufacture, import and export, out of which 93 are manufactured in India.[1] India currently exports Rs 1000 crores worth of pesticides and imports worth Rs 150 crores.

Use of pesticide in India is increasing at the rate of 2-5 per cent per annum and is about 3 per cent of the total pesticides used in the world[2]. However, the pesticide consumption in India is lower (0.5 kg/ha) as compared to other developed Asian countries like Japan (12kg/ha), Taiwan (17kg/ha), Korea (6.6 kg/ha)[3].

Fig 1: Anual production of pesticide



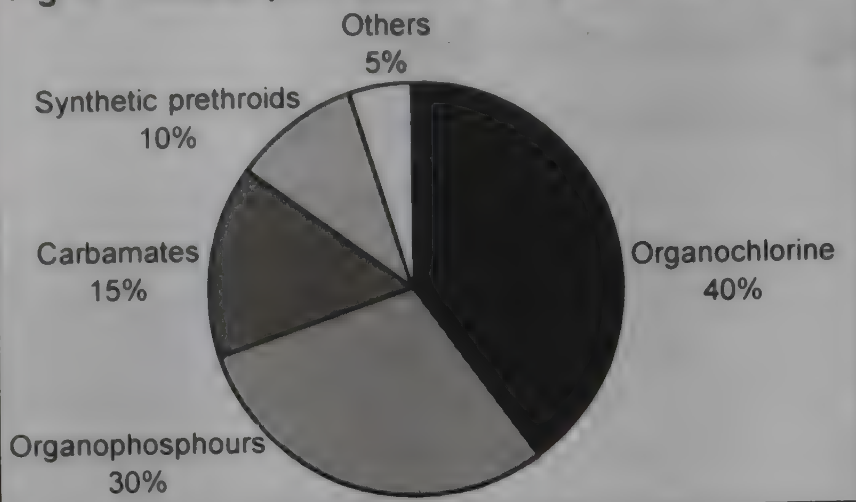
The bulk of the pesticides are used in the agriculture (almost 67 per cent)[4] and horticulture sector with only 8.5 per cent being used in the public health sector[5]. The pesticide demand for agriculture for the year 1998-99 was estimated to be around 57,240 MT (technical grade).[6] Maximum pesticide consumption is in cotton and rice crops with 54 per cent and 17 per cent respectively. Andhra Pradesh, Karnataka and Gujarat account for 65 per cent of the total pesticide consumption in country.[7]

Policy on pesticides

There is no comprehensive "national policy" on pesticides in the country. The Insecticides Act, 1968, serves as the policy document for regulating the manufacture, registration, use, export and import of pesticides in the country. The government agencies dealing with pesticides are functioning on the basis of various regulations provided under the Act.

Manufacture of pesticides also depends on the Industrial Policy of the country. For instance, if any

Fig. 2 : Consumption patterns of pesticides in India



company wants to manufacture a particular pesticide, after getting a registration from the Registration Committee for Pesticides (see next section), it needs to get clearance from the Ministry of Industry and Ministry of Chemicals and Petrochemicals to manufacture the pesticide. The Ministry of Industry, according to the industrial policy on each sector of industries will then grant the permission for manufacture.

Government control on pesticide

There are three main bodies formed under the Insecticides Act which regulates the pesticide in the country:

- **Central Insecticides Board:** Formed under Section 4 of the Act, is headed by the Director General Health Services and comprises of 29 members from different ministries. The Board is responsible for formulating policies regarding insecticides that may be included in "The Schedule" of the Act.
- **Registration Committee:** Formed under Section 5 of the Act, comprises of members from all the concerned ministries. The Committee is responsible for registration of insecticides for manufacture, import and export in the country. All pesticides manufactured, imported or exported in India has to be registered with this committee. The registration is done on the basis of scientific information provided by the manufacturing company, literature reviews and laboratory tests conducted by the agency itself.
- **Central Insecticides Laboratory:** The Central Insecticides Laboratory has been set up under the Section 16 of the Act, for quality control, safety, packaging and efficacy of pesticides. Apart from this, there are 42 State Pesticides Testing Laboratories, 2 Regional Pesticides Testing Laboratories to check the quality of pesticides being supplied in the market.

All the above bodies function under the Ministry of Agriculture which is the nodal ministry dealing with pesticides in the country. Other ministries dealing with pesticides are the Ministry of Chemicals and Petro Chemicals, the Ministry of Health and Family Welfare and the Ministry of Environment and Forests. According to the officials at the Ministry of Environment and Forests and the Ministry of Chemicals and Petro Chemicals, as well as the Supreme Court of India (AIR 1997 SC 2298 -1997), there is lack of co-ordination amongst the ministries dealing with pesticides.

The power to ban or restrict the usage of any pesticides lies with the Central Government,

through the Ministry of Agriculture. The Central government periodically sets up expert committees to review different pesticides, based on whose recommendations it bans, restricts or allows a pesticide to be used, imported or exported in the country.

Currently there are two main expert committees formed through the intervention of the Supreme Court of India, which are reviewing and advising the Government of India (GOI) on pesticide use in the country

- **Supreme Court Committee:** Constituted by the Supreme Court of India in 1997 (also see section on Legislation), is an inter-ministerial committee comprising of Secretaries from Ministry of Agriculture (Chairman), Ministry of Chemicals and Petro-chemicals, Ministry of Health and Family Welfare and Ministry of Environment and Forests respectively. This committee does not have any statutory powers or any fixed tenure, it acts as a "watch dog". According to its 'Terms of Reference', "it will review the use of insecticides and chemicals found hazardous to health once every three months and take suitable remedial measures...." The TOR also says that the Committee can take assistance of the technical expert committee whenever required.
- **Technical Expert Committee:** Under the directions of the Supreme Court inter-ministerial Committee, a technical expert committee has been formed in 1997 to assist the Supreme Court Committee in reviewing the pesticides. The Expert Committee, too doesn't have any statutory powers or fixed tenure. It reviews the pesticides and gives its recommendations, after consultation with the Registration Committee, to the Supreme Court Committee. Currently the Expert Committee is reviewing 28 pesticides, which are as follows:

Table 1: List of twenty-eight pesticides being reviewed by the Expert Committee (as on 15.7.99)[8]

2,4-D	Aldicarb
Aluminium Phosphide	Captafol
Captan	Carbaryl
Carbofuran	Chlorobenzilate
DDT	Dicofol
Dieldrin	Dimethoate
Endosulfan	Ethylene Dibromide (EDB)
Lindane	Malathion
Maleic Hydrazide	Methoxy Ethyl Mercury Chloride (MEMC)
Methyl bromide	Methyl parathion
Paraquat Dichloride	Phorate
Pretilachlor	Sodium cyanide
Thiram	Trichloro Acetic Acid
Tridemorph	Zinc Phosphide

Apart from the above-mentioned pesticides being reviewed, following pesticides have been banned in India. But "ban" may not mean total ban, it is usually qualified by whether it relates to use, manufacture, import, export. Which means, even though a pesticide is banned for use in India, it can still be manufactured and exported. Sometimes a pesticide banned for manufacture and use in India, is allowed to be imported and further exported to other countries, "in order to earn foreign exchange".

Table 2 : List of pesticides banned in India[9]

Aldrin*	Calcium Cyanide
Chlordane*	Copper Acetoarsenite
Di-bromochloropropane (DBCP)	Endrin*
Ethyl Mercury Chloride	Ethyl Parathion
Heptachlor*	Menazon
Nicotine Sulphate**	Nitrofen
Paraquat dimethyl sulphate	Pentachloro nitrobenzene (PCNB)
Pentachlorophenol (PCP)	Phenyl Mercury Acetate (PMA) **
Sodium Methane Arsonate (MSMA)	Tetradifon
Toxaphene*	Benzene Hexachloride (BHC)

**These pesticides are on the listed POPs chemicals currently being negotiated under the UN POPs treaty*

*** These pesticides are manufactured in India for export purposes only. In case of BHC, only the formulation is banned and not the technical grade. Therefore, if a company wants it can manufacture technical grade BHC and then export it.*

Following table gives the list of pesticides, which have not been completely banned but their use has been restricted.

Table 3: List of pesticides for restricted use in India (as on 15/7/99)

S.No.	Name of Pesticide[10]	Restricted use[11]
1.	Aluminium Phosphide	Aluminium Phosphide is to be sold only to government agencies and undertakings and is to be used under strict supervision of government experts or pest control operators whose expertise is approved by the Plant Protection Advisor to the GOI.
2.	Chlorbenzilate	The use of this chemical in agriculture is banned in the country. If required, it can be imported by government/ semi government organisations to prepare *folbex* strips and making it available to beekeepers for controlling honeybee mites in apiaries.

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S.No.	Name of Pesticide[10]	Restricted use[11]
3.	Captafol	This is to be used only as seed dresser. Its use as folier spray is banned in the country.
4.	DDT*	The use of DDT in agriculture is completely banned. Under very special circumstances warranting the use of DDT for plant protection, the State or Central Government may purchase it directly from Hindustan Insecticides Limited for using under expert government supervision. Use of DDT in the public health programme is restricted to 10,000 MT per annum, except in case of emergency.
5.	Dieldrin*	The use of Dieldrin is restricted only to locust control in desert areas by the Plant Protection Advisor to the Government of India.
6.	Ethylene dibromide (EDB)	EDB is to be used only as fumigant for pest control in food grains and that to only by the government, government undertakings, organisations like Food Corporation of India, Central Warehouse Corporation, State Warehouse Corporation and pest control operators whose expertise is approved by the Plant Protection Advisor to GOI.
7.	Methyl Bromide	Methyl Bromide is also to be used only as fumigant and its restrictions in the use are the same as of Aluminium Phosphide.
8.	Sodium Cyanide	The use of Sodium Cyanide is restricted in the country and it is to be used only for the fumigation of cotton bales by Plant Protection Advisor to GOI under expert supervision.
9.	Lindane	Use of Lindane formulation generating smoke for indoor use is prohibited in India. Lindane may be produced in the country for use in the control of insect pests of field crops and subject to the modification in the certificate of registration to this effect.
10.	Methyl Parathion	Use of Methyl parathion is permitted only on those crops where honeybees are not acting as pollinators. Its production is, however to be continued in the country for use in other crops and subject to the modification in the certificate of registration to this effect.

** These are in the 12 listed POPs chemicals targeted for elimination.*

Legislation & Regulation

The main law regulating pesticides in the country is The Insecticides Act of 1968, which came into force in 1971[12].

This Act regulates the import, manufacture, storage, transportation, sale, distribution and use of insecticides with 'a view to prevent risk to human beings and animals'. The various regulatory provisions made in the Act include compulsory licensing, inspection, analysis of samples, detention, seizure and confiscation of stocks, suspension and cancellation of license etc

The enforcement of the Insecticides Act is the joint responsibility of the Central and State Governments. The Central Government has been entrusted with the overall supervision and administration of the Insecticide Act, registration of the insecticides, whereas the State Governments have been empowered to grant license, to carry out field level enforcement and to proceed against the offenders. Two nodal statuary bodies, the Central Insecticides Board and the Registration Committee have also been constituted under the Act.

Apart from the Insecticide Act, the following Acts also regulate different aspects of pesticides[13]:

- **Poisons Act, 1919**, the Act empowers the Government for the import and sale of any particular poison(s) and also grant import licenses[14].
- **Indian Drugs & Cosmetics Act, 1940.** The manufacture, sale, distribution, import and quality standards of drugs and cosmetics are part of this legislation. As amended in 1995 it also covers insecticides, disinfectants and contraceptives[15].
- **Indian factories Act, 1940.** This Act covers the workers affected from poisoning due to lack of knowledge or negligence on part of owner or the worker. In addition, the Act prescribes maximum permissible threshold limits and levels of exposure for chemical and toxic substances.
- **Prevention of Food Adulteration Act, 1955.** The Act lays down the tolerance limits of pesticides in food and other items. So far limits have been laid for 50 insecticides only.
- **Water (Prevention and Control of Pollution) Act, 1974 and The Air (Prevention and Control of Pollution) Act, 1981.** The Water and Air Act encompass heavy penalties for polluting air and water resources. The Central and State Pollution Control Boards have been constituted under these Acts to monitor the pollution levels.
- **Narcotic Drug and Psychotropic Substances Act, 1985.** This covers poisoning due to consumption of some 77 substances.

- **Environment Protection Act, 1986.** The Act aims at reduction of toxicity arising from the use of hazardous chemicals and provides standards for quality of environment, control of emissions and safeguards for handling of hazardous substances. Powers have been given to Central and State governments to protect public health from chemicals including pesticides.
- **Consumer Protection Act, 1986.** This provides protection of goods of consumer interests against any contamination of consumer items.

From time to time, the Central Government has passed notifications regarding the cancellation and restrictions on the use of various insecticides. But validity of such notifications has been questioned in the light of the cancellation of the registration of BHC due to lacunae in the Insecticide Act and is being reviewed by the Central Government. (see annex. 7.1)

[1] S.K. Tannan, Secretary, Pesticide Association of India, June 1999.

[2] S N Puri, et al. 1998. *Affordable basis and compatible tactics*. Pestology Vol. XXII, No. 4, April 1998.

[3] N P Agnihotri. 1999. *Pesticide: Safety Evaluation and Monitoring*. All India Coordinated Research Project on Pesticide Residues. Division of Agricultural Chemicals, Indian Agricultural Research Institute.

[4] S N Puri, et al. 1998. *Affordable basis and compatible tactics*. Pestology Vol. XXII, No. 4, April 1998.

[5] The World Bank.1997. *Project appraisal document on a proposed credit in the amount of SDR 119.2 million to India for a Malaria control project.* Annex 2B: Revised Policy Letter for Insecticide Usage in The Enhanced Malaria Programme in India. Population and Human Resources Operations Divisions, Country Department II, South Asia Region. Report No. 16571-IN.

[6] Annual Report-1998-99. Ministry of Agriculture, Government of India.

[7] S N Puri, et al. 1998. *Affordable basis and compatible tactics*. Pestology Vol. XXII, No. 4, April 1998.

[8] Dr D Kanungo, Directorate of Plant Protection and Quarantine, Ministry of Agriculture, Government of India. Personal Communication.

[9] Ibid.

[10] Ibid.

[11] A K Raheja and G C Tewari. *Integrated Pest Management for sustainable agriculture.* A paper presented at the National Workshop on Women and Pesticides in November 1993, New Delhi.

[12] Dudhani, A.T. 1999: *Introduction of Regulatory Measures in India.* Alternatives to Pesticides in Tropical Countires, pp 12-15.

[13] Narayanswamy, M and Srinivasan V., 1998: *Commentary on Law Relating to Pesticides in India, Madras.*

[14] Seth S.D. and Lall S.B., 1991: current Status of Poisons Control in India, Proceedings of the World Health Organisation/ AIIMS Workshop on Establishment and Strenghtening of Poison Control Centres.

[15] Narayanswamy,M. and Srinivasan V., ibid 2.

Chapter 2

Precautionary tales

Persistent Organic Pollutants

Even though most of the listed Persistent Organic Pollutants (POPs) chemicals are either banned or restricted in India, there are evidences to show that some of the POPs pesticides are being clandestinely manufactured and sold in the domestic market as well as exported to other countries. A report[1] by Greenpeace International links "Indian companies to exports of POP pesticides including Aldrin, Chlordane, Heptachlor, DDT and BHC to a number of countries including nations where their use has long since been banned."

Some of the POPs pesticides like Aldrin, DDT (formulation), BHC are available at the local hardware shops in Delhi and also with local pest control agencies. But the standard and efficacy of these pesticides are questionable because of the uncertainty regarding its actual composition. Most of the time they are sold in unlabeled packets or boxes.

Table 1: Status of twelve POPs Chemicals in India

S. No.	Name of chemical	Status	Effective dates	Notification No. & date
1.	DDT	Banned for agricultural use and restricted use in public health sector to the tune of 10,000 metric tonnes (MT) of technical grade.	26.5.89	378 (E) 25.7.89
2.	Aldrin	Complete ban on manufacture, use, import and export.	20.9.96	648 (E) 20.9.96
3.	Dieldrin	Use restricted for Locust control in desert areas by Plant Protection advisor to the GOI.	15.5.90	382 (E) 15.5.90
4.	Endrin	Complete ban on manufacture, use, import and export.	15.5.90	382 (E) 15.5.90
5.	Chlordane	Complete ban on manufacture, use, import and export.	20.9.96	648 (E) 20.9.96
6.	Mirex	Never registered in India.		

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S. No.	Name of chemical	Status	Effective dates	Notification No. & date
7.	Heptachlor	Complete ban on manufacture, use, import and export.	20.9.96	648 (E) 20.9.96
8.	Hexachloro Benzene	Complete ban on manufacture, use, import and export.		
9.	Toxaphene	Complete ban on manufacture, use, import and export.	25.7.89	569 (E) 25.7.89
10.	Polychlorinated Biphenyls (PCB) (Industrial chemical)	Banned for use. According to the Ministry of Chemicals and Petro Chemicals, PCB was never manufactured and was always imported into India. Since 1990 there has been a complete ban on its import and usage. But according to the Ministry of Environment and Forests, no PCBs have been manufactured or imported since 1965.	Conflicting years— 1990 or 1960?	
11.	Dioxins*	No data available.		
12.	Furans*	No data available.		

Note : Indian Toxicological Research Centre (ITRC) is compiling an inventory on PCBs and Furans in the country. The facility to test dioxin levels is not available in India

* Unintentional POPs from the industrial processes.

Export

As mentioned in the earlier section, some of the pesticides which are banned in India for use are manufactured and exported to other countries. Even a few of the listed POPs are exported to the neighbouring as well as far off countries. For instance, between April 1998 and January 1999, India exported 185,595 kilograms of DDT to Bangladesh, Japan, Nepal, New Zealand, Italy, Japan and Australia.[2]

According to Dr Kanungo,"HIL (Hindustan Insecticides Limited) has been given permission to manufacture 10,000 MT of DDT (T) for public health purposes, but at the moment we require much less, approximately 5000 MT. If HIL wants it can export the surplus DDT." India exported 212847 kg of Aldrin between April'98-January'99 to 20 countries including Australia, the Netherlands, and the USA.[3]

Table 2: POP pesticides exports from India for the period Apr. 1998–Dec. 1999.

Name of Product	Country	Qty (in Kgs.)
D.D.T	Australia	22000
	German F Rep	20150
	Israel	20000
	Bangladesh	40000
	Belgium	1000
	Chinese Taipei	11500
	Italy	48200
	Japan	16000
	Nepal	1695
	Spain	1000
	USA	4000
	Total	**185595**
Aldrin	Bangladesh	8300
	Brazil	5130
	Chinese Taipei	17550
	China People's Rep.	6000
	Denmark	9000
	Egypt	4600
	France	15640
	Germany	1760
	Italy	13000
	Kenya	376
	Korea Rep.	100
	Mexico	10000
	Netherland	84340
	Saudi Arabia	10800
	Singapore	100
	Turkey	13173
	United Arabs Emirates	12500
	USA	23
	Vietnam Soc. Rep.	200
	Zambia	250
	Total	**212847**
Chlordane	Bangladesh	16000
	Egypt	27000
	Total	**43000**
Lindane	Australia	2000
	Baharain	20000
	Belgium	60000
	Germany	3000
	Malasiya	3000
	Netherland	12500
	Saudi Arabia	15875
	Spain	18000
	Thailand	1000
	USA	27500
	Total	**162875**
Sodium Penta Chlorophanate (Santobrit)	Belgium	24500
	Netherland	4000
	Peru	3000
	South Africa	19000
	Thailand	27500
	Uganda	500
	UK	30685
	Total	**113685**

Source: Chemexil, Bombay.

POPs stockpiles

Apart from manufacture, use and export, the main problem with POPs pesticides and date expired pesticides is the stockpiles and its disposal. Though it is certain that there are stockpiles of date-expired and banned pesticides in the country, the exact quantity and type of pesticides stockpiled are uncertain. According to the Greenpeace report "....old pesticides would most likely be released into the market in the form of substandard formulations. This

matches reports from Nepal and Bangladesh that substandard and banned pesticides often enter their countries from illegal formulators in India."

So far the government has not come up with any policy or technical guidelines regarding the disposal of stockpiles of date expired pesticides. According to Dr Kanungo of Directorate of Plant Protection "the best way to phase out a pesticide is to use up its stocks within a stipulated time period and then ban it. As for the stockpiles of date expired pesticides, we are still not sure how to dispose it,...only option is incineration. But we do not have efficient incinerator technology in the country." An expert committee constituted by the Directorate of Plant Protection had given recommendations on destruction technologies for date expired pesticides (see annex. 7.2), emphasizing mostly on incineration and landfill technologies.

Ineffective bans and misplaced priorities

Aldrin, one of the Persistent Organic Pollutants (POPs) listed under UNEP for global elimination has been banned for use, manufacture, import and export in India since 1996. However, Aldrin is still available at the local hardware shops in Delhi and also with local pest control agencies. There is data showing export of Aldrin to other countries, where it is legally banned as well, long after the ban in India came into being. Between 1998-99, 212847 kilograms of Aldrin has been exported from India.

This not only illustrates the loopholes in the pesticides legislation in the country but also apathy of the enforcement agencies. Due to lack of clear pesticide policy in India, banned pesticides are being replaced by equally harmful chemical pesticides, which may have even longer and graver human health and environmental ramifications.

In India, Chloropyrifos, a non-systemic contact insecticide with stomach and respiratory action has now started replacing Aldrin for termite control. This is used for controlling crop pests including soil insects and is the preferred choice for termite proofing of buildings. It has a control span of over 20 years.

Toxics Link found out, during one of its field visits to the agricultural areas on the outskirts of Delhi, that farmers are now using Chloropyrifos not only for termite control but also on many crops like, paddy, maize, wheat, vegetables and fruit crops. The farmers spray Chloropyrifos after each harvest as the area is infested with termites. The land is tilled and then sprayed with Chloropyrifos. After spraying, the land is left fallow for sometime for pesticide to act. This is a common practice all over India.

The total demand for Chloropyrifos (93% techincal) in India is 3000 tonnes per annum, where as the installed capacity is 4500 tonnes per annum. Most of the manufacturing units are located in Gujarat and Maharashtra (western India).

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Major companies manufacturing Chlorpyrifos in India are:

- Ficron Organics Ltd, Gujarat
- Amico Pesticides Ltd, Maharashtra
- Lupin Agrochem India. Ltd. Maharashtra
- DeNOCIL, Mumbai
- Mistu Industries Ltd. Vapi, Gujarat ,
- Vantech Pesticides Ltd. Hyderabad
- Siris India Ltd, Andhra Pradesh
- Tantech Agrochemicals, Tamil Nadu
- Gharda Chemcials Ltd, Maharashtra

India also exports Chloropyrifos to Singapore, Malaysia, Thailand, Bangladesh, Australia, Saudi Arabia, Argentina to the tune of 1000 tonnes per annum approximately.

In many developed countries like the US, EU, there has been growing criticism against the use of Chlorpyrifos due to its high toxicity and endocrine disrupting properties and are being slowly phased out. Which bring us back to the issue of lack of pesticide policy in the country, strong lobby from the pesticide industry and the government mind set of replacing one chemical with the other without emphasizing on the use of safer, community based alternatives and solutions.

[1] Von Hernandez, Nityanand Jayaraman. 1998. *Toxics Legacies; Poisoned Futures*. Greenpeace International; Amsterdam. Pp 37.

[2] Ibid.

[3] Ibid.

Chapter 3

To spray or not to spray

DDT and Public Health

The Government of India has banned the use of DDT in the agriculture sector in late 1980's and restricted its use in public health sector, mainly for malaria control [10,000 metric tonnes (MT) of technical grade]. The current demand for DDT (50 per cent WP-wettable powder) in public health is around 5000 MT for the whole country. Insecticide usage in the malaria control programme constitutes about 8.5 per cent of the total usage of pesticides in the country.[1]

Though DDT is still the "insecticide of choice" in the country for vector control, there is growing evidence that DDT is slowly "dying its own death". Reason being the widespread resistance of the mosquito vectors to DDT and the environmental issues associated with the continued use of DDT.

DDT production

The first DDT plant in India was set up in 1954 in Delhi by the Hindustan Insecticides Limited (HIL), a public sector undertaking. The plant was a gift from the World Health

Table 1 : Quantitative details of the HIL plants: Capacities, sales and stocks of DDT during the year 1997-98[3]

Item	Licensed/ Installed capacity (MT)	Production (Qty in MT)		Sales (Qty in MT)		Closing Stocks (Qty in MT)	
		1997-98	1996-97	1997-98	1996-97	1997-98	1996-97
DDT (T)							
Delhi unit	2744	0	1267	0	1	0	256
Alwaye unit	1344	1314	1104	0	0	7	48
Rasayani unit	5000	2901	1778	0	0	137	181
Total	**9088**	**4215**	**4149**	**0**	**1**	**144**	**485**
DDT (F)							
Delhi unit	5488	0	1544	0	1644	0	1
Alwaye unit	2688	2449	2061	2471	2018	22	45
Rasayani unit	10,000	6409	4621	6071	4545	490	149
Total	**18176**	**8858**	**8226**	**8542**	**8207**	**512**	**195**

Note: The HIL Delhi plant was given closure order by the Supreme Court w.e.f 30.11.96 as part of a judgement directing polluting industries to shift out of the National Capital Region.

Programme (WHO) to manufacture 700 MT of DDT and its 50 per cent formulation for malaria control in the country. Currently HIL has an installed capacity for manufacturing up to 9088 MT per annum of DDT. HIL is the sole manufacturer of technical grade DDT in the country and has two plants in Alwaye (Udyogmandal in Cochin, Kerela) and Rasayani (Maharashtra) respectively.[2]

Partly due to the restrictions in the usage and partly due to growing vector resistance, DDT production has decreased in the country. New class of pesticides like Organophospahtes (Malathion) and Synthetic Pyrethroids are replacing DDT and are being used for both agricultural and vector control.

Table 2: DDT (Technical grade) production in the country, 1992-93 to 1997-98 (in metric tonnes)

Year	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Production	6722	5960	4252	6017	4149	4215

Source: Data from 1992-96 provided by the Pesticide Association of India. Data from 1996-98 taken from HIL Annual Report 1997-98.

DDT consumption

Currently DDT is being manufactured and used 'exclusively' for the National Anti Malaria Programme [NAMP] (previously National Malaria Eradication Programme) in the country. Apart from malaria, this programme is also responsible for controlling other vector borne diseases like Dengue Fever, Kalaazar, Japanese Encephalitis.

Table 3: DDT, BHC and Malathion production by HIL for NAMP (Qty. in MT)

Pesticide	1996-97	1997-98
DDT (F)	8206	8542
BHC*	0	0
Malathion (F)	224	575
Malathion(T)	20	20.5

Note: *Production of BHC has been banned in the country since 1st April 1997.
Source: HIL Annual Report 1997-98.

According to estimates provided by the NAMP, between 1998-99, 5800 MT of DDT (50 per cent) was consumed for vector control in the country and for the year 1999-2000 the proposed quantity for allotment of DDT (50 per cent) by NAMP is 5000 MT. According to Dr S M Kaul, Joint Director, NAMP, the reason for the decrease in the DDT consumption is due to "the growing vector resistance to DDT and availability of other pesticides like malathion, synthetic pyrethroids." The usage of DDT has been stopped in urban areas under the Urban Malaria Scheme (UMS).[4] As of now, DDT is used only in rural areas, and in urban areas larvicides like Synthetic Pyrethroids-Temephos (commonly

known as Abate) and Fenthion, and Mosquito Larvicidal Oil (MLO, a petroleum product) is being used. Malathion (25 per cent) is also used in large extent for fogging in urban areas. According to Dr Kaul, "In urban areas, door to door residual spraying of DDT is not feasible and acceptability of indoor residual spray is very poor, whereas, in rural areas acceptance is high and people do not mind indoor spraying."(see annex. 7.4)

The table below indicates a gradual decrease in the DDT consumption in the last 10 years. One of the reasons for the decrease in consumption and demand for DDT can be a shift towards other chemical pesticides as vectors are fast developing resistance to DDT. Since there has been no quantification as to how much bioenvironmental control measures contributes to the vector control programme, it is difficult to say whether the decrease in DDT consumption can be attributed to adoption of alternative measures.

Table 4: Trends in pesticides consumption for public health between1988-99 (in MT)

Year	DDT (75%)	DDT (50%)	BHC (50%)	Malathion (25%)
1988-89	2500	13,556	8,048	-
1989-90	-	10,657	8,764	1,800
1990-91	-	12,845	8,464	1,100
1991-92	-	11,730	8,999	1,700
1992-93	-	11,525	8,072	100
1993-94	-	12,750	7,479	-
1994-95	-	8,482	6,722	700
1995-96	-	10,850	7,584	350
1996-97	-	7,606	3,204	224
1997-98	-	7,489	-	575
1998-99	-	5,800	-	2,200
Total	**2,500**	**16,2078**	**67,336**	**8,749**

Source: State of India's Environment: The Citizen's Fifth Report, Part II: Statistical Database. Centre for Science and Environment (1999).

DDT export

Though manufactured solely for internal use for vector control purposes, DDT is being exported outside the country. According to Chemexil data, between April 1998 and December 1999, India exported 185,595 kilograms (185 MT) of DDT to Australia, Bangladesh, Belgium, Nepal, Isarel, Italy and USA. Interestingly this pesticide is banned in many of these countries.

Table 5: Exports of DDT (T) from India during the year 1991-92 to 1998-99 (in tonnes)

Year	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
DDT	53	107	150	51	191	54	175	185

Source: HIL Annual Report 1997-98.

The following table illustrates the reasons for its continued use and also examines why DDT is facing a phase out.

Table 6: The case 'for and against' DDT in India

For DDT	Against DDT
1. **Government's attitude:** Although there is increasing vector resistance to DDT and other insecticides, indoor residual spraying is still a major component of the vector control programme because[5]: **A.** It is demanded by many politicians at all levels. **B.** Institutional inertia on part of the government agencies to shift to non-chemical measures. **C.** Most of the malaria officers were trained during the eradication era and believe that malaria control demands more insecticide and drug use. **D.** Concern over loss of jobs at Hindustan Insecticides, Government of India owned enterprise and the sole domestic producer of DDT, contributes to GOI's reluctance to decrease insecticide use.	1. **Low vector mortality:** The main reason for the use of DDT is its ability to kill mosquitoes. However, the major species of mosquitoes have developed resistance to it. **A.** Susceptibility status against DDT by *Anopheles culicifocies*, the major malaria vector in the country shows resistance of more than 40% from most part of the state (resistance refers to below 80% mortality).[6] **B.** Adults of *An. Stephensi*, mostly an urban vector, are found resistant to both DDT and BHC.[7]
2. **WHO study and recommendation:** In 1993, a WHO group studied the current situation on the use of DDT for controlling vector borne diseases, especially malaria and concluded that: "DDT exposure as a result of indoor residual spray does not provide convincing evidence of adverse effects and; there was limited justification on toxicological	2. **Adverse impact on environment and human health:** Number of Indian studies have shown DDT residues in bovine milk, breast milk, vegetables, honey, friuts, soil, birds-vultures, eggs of fishing eagle and wheat flour. (see section on Indian studies on pesticides residues in the environment and food)

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For DDT	Against DDT
or epidemiological grounds for changing current policy towards indoor residual spray of DDT." WHO recommended that DDT can be safely used for indoor spraying. The Government of India Expert Committee (1995) on Malaria share the same view.[8]	The annual report of Ministry of Agriculture for 1998-99 notes that "....wide spread, indiscriminate and injudicious use of these toxic pesticides has been causing several adverse effects such as human and animal health hazard, poisoning and pollution of air, water and soil, residues in food and fodder, ecological imbalance, pest resurgence."[9]
3. **Attitude of people:** Despite growing dissatisfaction with household spraying, most of the people still equate malaria control with annual visits from spray teams.	3. **Falling acceptability by the households for indoor residual spraying:** According to NAMP, one of the reasons DDT spraying has been discontinued in urban areas is, "non acceptability by urban hosuehold", Whereas in rural areas, people do not mind indoor residual sparying.
4. **Cost comparison of DDT with other insecticides:** DDT has always been the first choice because of its low cost. DDT and BHC (used till 1997) are cheapest at Rs 10 per capita per annum. It costs twice as much to use Lindane (used as a substitute for BHC on a trial basis), 4 times as much to use malathion, and 5 times as much to use deltamethrin or any other synthetic pyrethroids.[10]	4. **Cost comparison of DDT spray and integrated approach to malaria control:** Under the World Bank Enhanced Malaria Control Programme (see section on NAMP and use of DDT), it is shown that annual per capita cost of integrated early detection and prompt treatment is around Rs 3 for an area in which the annual blood examination rate is 10 per cent and the slide positivity rate is 2.5 per cent (suggesting a minimum annual parasite index of 2.5/1000). In comparison, the annual cost per capita of spraying this same area would be Rs 10 for DDT and Rs 45 for Deltamethrin.[11] Depending on the incidence of malaria in the area, a choice can be made between the integrated approach and DDT spraying, instead of going for spraying alone.

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For DDT	Against DDT
5. Operational coverage and monitoring in integrated approach: Any integrated approach /programme will need constant surveillance, monitoring and larger manpower. Given the fact, that even for spraying of insecticide there is a severe shortage of manpower, it will require better organising of the existing manpower and new recruitment.	**5. Poor operational coverage:** Officials at the national and state levels dealing in public health sectors state severe shortage of manpower and inability of the states to increase the wages of spraying staff resulting in reduced compliance and poor coverage.
	6. Reduced export potential: India is world's second largest grower of fruits and vegetables but only one percent of production is commercially processed and only a few products are exported. Agricultural exports are supposed to reach US$ 650 million by 2000 (Country Economic Memorandum, World bank, 1996) but exports of fruits and vegetables maybe hampered by concerns about DDT from theft and leakage into agriculture.[12]

National Anti Malaria Programme and the use of DDT

Background

The first successful programme for the control of malaria in the country under the National Malaria Control Programme (1953) was attributed to the residual spraying with DDT. The programme was changed to the National Malaria Eradication Programme (NMEP) in 1958 with the objective to eradicate malaria in 7-9 years. By 1965, under NMEP, the annual malaria incidence fell from 75 million cases to 0.1 million cases. But from 1968 onwards there was a resurgence in the malaria cases and reached 6.47 million cases by 1976. In 1977 attempts at eradicating malaria were abandoned and under the revised policy, a Modified Plan of Operation (MPO) was adopted. All this while the main insecticide for controlling malaria remained residual organochlorine— especially DDT and was first imported in India in 1948 for malaria control. Between 1958-63, under a USAID programme DDT was donated to India while the manufacturing capacity within the country was being developed. Subsequently India imported 60 per cent of the annual requirement of 9,000-16,000 MT of DDT, with remainder to be manufactured locally. But there were delays in imports and interruptions in the local production due to various reasons (labour strikes) that resulted in an annual shortfall of 13-34 per cent of the required quantity.[13]

After the implementation of the MPO, the malaria cases and deaths decreased initially and remained static for a while. But from 1994 onwards the malaria cases and related deaths in the country went up, with 1122 deaths due malaria in 1994 and in 1996 the figure was 1010 (3.04 million total reported malaria cases). In 1997, there were total 2.35 million malaria cases reported in the country. In 1997, insecticide spray was done selectively and BHC was replaced by "suitable" insecticide since BHC was banned. Total population projected for residual spraying by NMEP for 1997-98 was 164.75 million out of which the projected population under DDT spray was 123.37 million and for Malathion was 41.38 million.[14] During 1998 the malaria incidence continued to decrease as compared to 1997. A total of 2.10 million positive cases and 0.91 million *P. falciparum* cases were reported (see 7.3)

In urban areas, under the Urban Malaria Scheme, apart from the use of insecticides (barring DDT), source reduction measures are been applied. Like:

- filling ditches, pits, low lying areas, streamlining channelising, desilting, deweeding, trimming of drains, water disposal and sanitation, emptying water containers once in a week and observing weekly dry day etc.

In case of rural areas, so far the thrust is towards use of residual indoor spraying of insecticides. In 1997, malaria control strategy was revised and with World Bank funding a new programme "Enhanced Malaria Control Project" was launched under NMEP for a period of 5 years. The project covers tribal population (six crores) in the seven peninsular states-Andhra Pradesh, Bihar, Gujarat, Madhya Pradesh, Maharastra, Orissa and Rajasthan. In the seven states the project is implemented in 100 districts comprising of 1045 Primary Health Centres (PHCs). Total budget for the project is Rs 891.04 crores.

Even as the project completes three years, rate of success of these bioenvironmental control measures is yet to be evaluated. According to NAMP officials there has been a gradual shift from chemical insecticides to alternatives especially in Maharastra, Gujarat and Andhra Pradesh.

National policy on insecticide use under NAMP

The insecticide policy for vector control of NAMP clearly states "as long as DDT offers an epidemiological impact, irrespective of the vector susceptibility status to it, DDT should be the insecticide of choice." The current NAMP programme is largely dependent upon indoor residual spraying and about 75 per cent of the NAMP budget is spent on purchase and application of insecticides. The policy also states that regular spray operations have to be carried out in all the areas with Annual Parasite Index (API) of 2 or above with appropriate insecticides. Priority of spray is given to 'high risk areas' where the epidemiological data of preceding three years are considered for selecting the population protected. The insecticide

requirements are given per million populations per annum. Proportionate calculations are made for smaller population.

When vector resistance is found by repeated field tests (WHO kit) and it is confirmed that there is no epidemiological impact on malaria incidence in the community inspite of good quality and coverage of residual insecticide spray, a proposal for change of insecticide is put up. The new insecticide chosen to replace the insecticide against which resistance has been observed is decided on the basis of the susceptibility of vector to the alternative insecticide and the state government has to submit documented evidence on vector resistance studies and field observations on epidemiological impact of spray in respect to the new insecticide.

Table 7: The policy states the following strategy to be adopted for change of insecticide

Resistant to	Alternative insecticide
DDT	Malathion
DDT and Malathion	Synthetic Pyrethroids

Note: BHC was being extensively used for vector control and agriculture purposes till April 1997. Government of India decided to withdraw BHC due to development of vector resistance to BHC through out the country.

Anopheles Culicifacies, a major malaria vector in India has reportedly shown more than 40 per cent resistance to DDT in most parts of the country. Gujarat, Maharastra, few districts of Karnataka and some parts of Orissa have reported high resistance of this malarial vector species to DDT. This vector species is fast developing resistance against Malathion as well in Gujarat, Maharastra, Karnataka.[15] Due to the growing resistance of vector species to organochlorines (DDT & BHC) and Organophosphates (Malathion), now the thrust is towards applying synthetic pyrethroids (Deltamethrin). The insecticide policy reflects shift from one class of chemicals to the other without emphasising on the use of non chemical methods or an integrated approach.

The following insecticides are being used in the country for public health purposes (population wise)[16] :

1. 150 MT per annum of DDT (50 per cent) per million population for two rounds of spray.
2. 900 MT per annum of Malathion (25 per cent) per million population for three rounds of spray.
3. Synthetic Pyrethroid:
   - 60 MT per annum of Deltamethrin (2.5 per cent) per million population for two rounds of spray.
   - 18.75 MT per annum of Cyfluthrin (10 per cent) per million population for two rounds of spray.

Policy on insecticide usage under the World Bank aided Enhanced Malaria Programme

Under the Enhanced Malaria Programmme, a Revised Policy Letter for Insecticides Usage has been drafted which states:

- The use of DDT should be gradually phased out and the available alternative utilised for public health programmes. Limited use of DDT, however, to cater to need of specific epidemic prone areas and malaria endemic regions and also Kala-azar control could be continued in a targeted manner for immediate future.
- A group chaired by the Secretary of the Ministry of Health and Family Welfare, with representatives of the Planning Commission, Department of Biotechnology and Department of Agriculture and Cooperation, will review the parameters of DDT use on an annual basis. This will focus on pre-determined use of insecticides, and on use in response to epidemics or demands.

The Enhanced Programme also requires NAMP to develop specific guidelines based on expert review and operational research:

- Criteria and complete data requirements needed to evaluate the efficacy of insecticides (DDT and others) used for vector control, especially in the light of the considerable levels of insecticide resistance that are known to occur in India. This will specifically include an objective assessment of where DDT works and where it does not taking into consideration the epidemiological impact. This may involve WHO testing criteria, and the results should help determine the need to shift to another insecticide in any given area.
- Criteria for stopping use of indoor residual spraying in epidemic or non-epidemic control activities.

Source: The World Bank.1997. Project appraisal document on a proposed credit in the amount of SDR 119.2 million to India for a Malaria control project. Annex 2B: Revised Policy Letter for Insecticide Usage in The Enhanced Malaria Programme in India. Population and Human Resources Operations Divisions, Country Department II, South Asia Region. Report No. 16571-IN.

Budget

The National Anti Malaria Programme, is the largest national health programme in the country with around 30 per cent of the total union health budget spent on malaria control alone. The Programme is based on 50:50 cost sharing basis between States and Central Government. The Central Government provides assistance in the form of materials like

Table 8: Costs of some of the insecticides used for malaria control

Name and Qty.	Costs
1 MT of DDT (approx.)	Rs 60,000-70,000
1 MT of Malathion	Rs 44,000 (approx.)
1 MT of Synthetic Pyrethroids	In Lakhs

insecticides, anti-malarial drugs, larvicides etc. while the State Government meet the expenditure on the required material and operational costs. The Budget for Urban Malaria Scheme for the year 1998-99 was 1197.35 lakhs.

For 1997-98 the budget (provision) for the Programme was Rs. 19000 lakhs (including Rs 5000 lakhs from the World Bank for the Enhanced Project). Out of 100 district selected in this project, 94 has constituted District Malaria Control Societies and formulated District Implementation Plans.

Economics

One of the reasons why DDT still remains the first choice for malaria control is its cost effectiveness as compared to other insecticides. Per capita cost of DDT is around Rs 10 per annum. Though the cost of 1 MT of Malathion is less than that of 1 MT of DDT, the dosage requirement varies greatly—DDT dosage requirement is 150 MT/million population whereas Malathion requirement is 900 MT/million population. Therefore, if Malathion is chosen for spraying, the cost escalates quite considerably.

Table 9: Current status of malaria incidences in Rajasthan

Year	Number of Malaria Cases	
1997	Blood slides: Malaria cases: Falciparum cases:	60,00,754 2,72,670 19,742
1998	Blood slides: Malaria cases: Falciparum cases:	49,77,977 76,438 10,030
Till 15th May 1999	Blood slides: Malaria cases: Falciparum cases:	12,92,792 6341 1113

Table 10: Total demand for DDT in Rajasthan

Year	Amount
1998	1500 MT/annum
1999	1500 MT/annum

A case study of Rajasthan

The state of Rajasthan was chosen for a small case study to understand the administrative and distribution channel for DDT in a state, process of determining the demand for DDT, its usage and malaria control scheme at the state and district levels. Rajasthan is also the single largest consumer of DDT for vector control in the country.

Background information

The cost of malaria control in Rajasthan is shared 50 per cent by the Central Government and 50 per cent by the State Government. Central Government (through

NAMP) allots the insecticides, where as the actual requirement distribution and spraying of the insecticides is done by the State Government.

According to officials at the Directorate of Medical Health, Jaipur, (Rajasthan) the order for DDT is placed with the Central Government one year ahead from the year of actual use. That is, DDT is kept in stock to be sprayed next year. This is done to make sure that the DDT is readily available at the time of spraying, since there are delays in delivery of the DDT to the State from the Centre. According to the officials, DDT can be stored and used for two years from the date of manufacture.

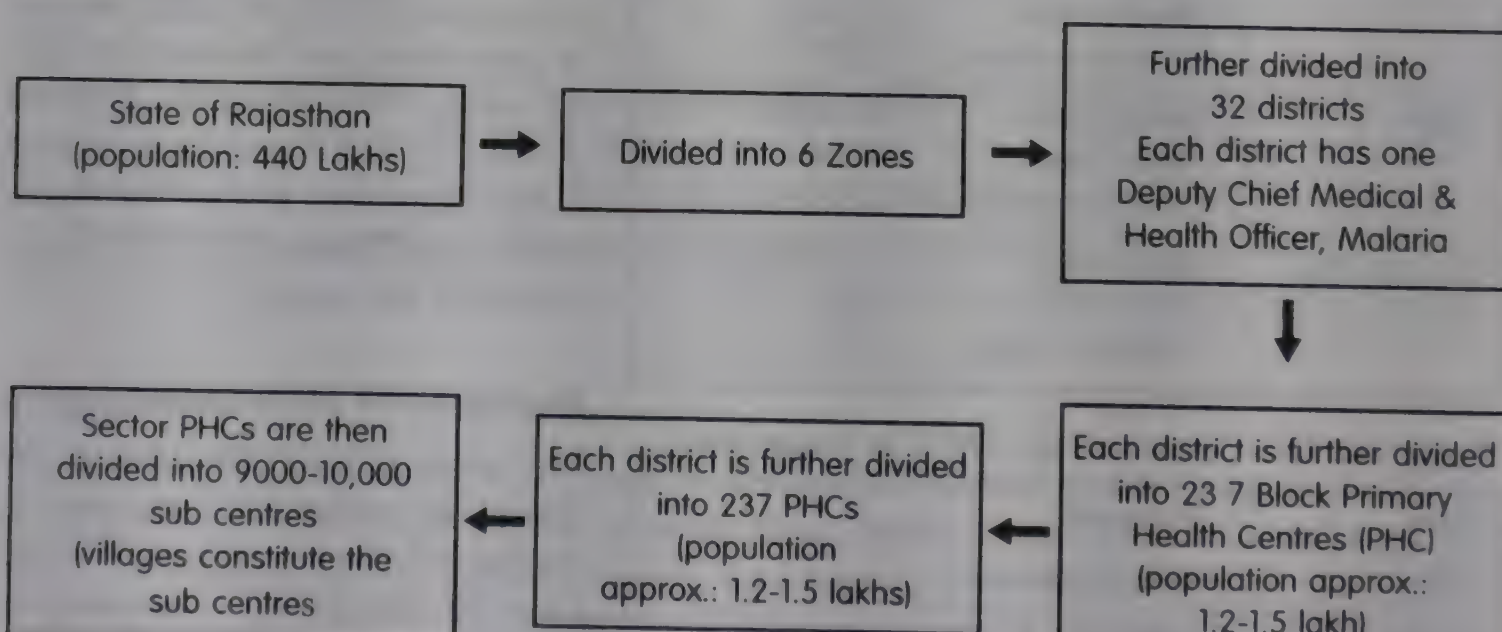
In 1998, 1500 MT of DDT was used in Rajasthan to spray 1 crore population (approximately). In 1999, when the case study was been done, there was a stock of 1500 MT of DDT in Rajasthan for the current year.

Note: The DDT demand of 1500 MT for the years 1998 and 1999 respectively, as provided by the State government, does not match with the figures provided by the NAMP, which says the DDT allotted to Rajasthan in 1998-99 was 1750 MT and for 1999-2000 is 1100 MT. [According to the officials at the Directorate of Medical Health, Jaipur, its up to the Central government's discretion as to how much DDT needs to be allotted to each state].

Malaria Control Programme in the state of Rajasthan

To understand the distribution and the government control on usage of DDT and other insecticides in the State, it is necessary to look at the malaria control scheme and the various levels of decision making at the State level.

The programme for Malaria control in the State has been divided into following levels:



How is the demand for DDT determined?

Deputy Chief Medical & Health Officer, Malaria, at the district level determines the amount of DDT needed for spraying for each year based on epidemiological data of the preceding three years. The data indicates the "high risk areas" and accordingly amount of DDT required is determined for indoor residual spraying. On the basis of the subcentre population (villages), calculations are made for the total population that requires DDT spraying.

The following flow chart depicts the procedure for procuring DDT by the State government:

The Deputy Chief Medical & Health Officer (Malaria), collects information at the district level from the Block PHCs, Sector PHCs and Sub Centres about the DDT requirement for indoor residual spraying for the year.

↓

The District Deputy Chief Medical & Health Officer, Malaria then sends the order for DDT to the State Health Department of the State Government.

↓

State Government sends the order for DDT to the National Anti Malaria Programme (NAMP).

↓

NAMP sends the DDT order to Ministry of Health and Family Welfare, Government of India.

↓

Ministry of Health and Family Welfare decides how much DDT is to be allotted on priority basis depending on the demands from other states and —1. An allotment letter is issued to the state government; 2. An intimation is also sent to the DDT manufacturing firm (Hindustan Insecticides Limited).

↓

NAMP sends the DDT allotment letter to the state government, which then sends the consignment instructions to the HIL—as to where, when and the amount of DDT to be sent at different districts. The amount of DDT needed at different districts is determined earlier by the state health department in consultation with the District Deputy Chief Medical & Health Officer, Malaria. The DDT consignment reaches the districts directly from the manufacturing firm.

Pattern and period of DDT usage

DDT is used only for indoor spraying in the rural areas of Rajasthan as houses are made of mud walls which absorbs the DDT. There are two rounds of indoor residual spraying of DDT. DDT remains effective for 10-12 weeks during the two rounds of spray. The DDT sprays are done during pre- and post monsoon period to control/kill the adult mosquitoes inside the houses. The sprays are conducted during :

- First round: 15th May–31st July.
- Second round: 1st August–15th October.

In urban areas instead of DDT, anti larval sprays like MLO (Malarial Larvicidal Oil-petroleum bi-products), Malathion, Abate, Batex is used for spraying and source reduction techniques are applied.

According to sources at the Jaipur Municipal Corporation, the Corporation regularly buys BHC and DDT from the malaria control "people" at Udaipur and Alwar districts to dust insecticides along the drains in Jaipur. It is to be noted that the DDT and BHC bought by the Corporation are the ones allotted for malaria control in the above-mentioned districts and not to be used for sanitation purposes in Jaipur.

Storage of DDT and other insecticides

According to sources in the Jaipur Municipal Corporation, DDT and other insecticides are stored in gunny bags in old abandoned forts and houses all over Rajasthan. No special care is taken to store them in shed or in cool places. They are stored haphazardly in open in these places. There are unconfirmed reports of open burning of stockpiles of date expired DDT and BHC in the state.

Stockpiles of date expired DDT in Rajasthan

Due to fear of being charge-sheeted and serious official repercussions, concerned officials refused to give any information on DDT stockpiles. Which confirms the fact that stockpiles of DDT and other insecticides remain stored in the State.

One of the reasons for unused stocks of DDT in the State has been attributed to the lack of "man power" and "inadequate spraying facility" inspite of availability of the required amount of DDT.

There is about 1300 MT of BHC stock in Rajasthan, lying in abandoned forts and houses across the state, which have been banned for usage for any purpose in India since April 1997.

Use of alternatives for malaria control in Rajasthan

There has been some integrated approach towards control of malaria in the state. Apart from the insecticide use, anti larval measures, source reduction methods, bednets, bio-larvicides are being used in some areas. One of the reasons cited by the government official for reducing the dependency and usage of DDT in the state is the development of resistance by vector to DDT all over the country. According to officials, the vector will develop resistance to Malathion, Pyrethroids and other new generation insecticides much faster than it has done to DDT.

Note: All the information in the case study is based on personal communication with the officials at the Directorate of Medical Health, Secretariat, Jaipur, Rajasthan.

[1] The World Bank.1997. *Project appraisal document on a proposed credit in the amount of SDR 119.2 million to India for a Malaria control project.* Annex 2B: Revised Policy Letter for Insecticide Usage in The Enhanced Malaria Programme in India. Population and Human Resources Operations Divisions, Country Department II, South Asia Region. Report No. 16571-IN.

[2] HIL Annual Report 1997-98.

[3] Ibid.

[4] Urban Malaria Scheme (UMS): In 1969, Madhok Committee, constituted to review the malaria situation in India felt that if effective anti-larval measures were not undertaken in the urban areas, the proliferation of malaria cases from urban to rural areas might spread in a bigger way in many states and recommended adequate central assistance for tackling the problems. UMS was sanctioned in 1971 and till date has 131 towns and cities in 17 states and Union territories covering a population of about 80 million.

[5] Ibid note 1.

[6] National Malaria Eradication Programme. *Country Scenario: Malaria and its control in India 1997-98*. Pp 73.

[7] Ibid note 1.

[8] Ibid note 1.

[9] Annual report 1998-99. Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. Pp 66.

[10] The World Bank.1997. *Project appraisal document on a proposed credit in the amount of SDR 119.2 million to India for a Malaria control project.* Annex 2B: Revised Policy Letter for Insecticide Usage in The Enhanced Malaria Programme in India. Population and Human Resources Operations Divisions, Country Department II, South Asia Region. Report No. 16571-IN. Annex 4: Economic Assessment. Population and Human Resources Operations Divisions, Country Department II, South Asia Region. Report No. 16571-IN

[11] Ibid.

[12] Ibid note 1.

[13] VP Sharma.1987. *Community-based Malaria control in India.* Elsevier Publication, Cambridge 0169.

[14] National Malaria Eradication Programme. *Country Scenario: Malaria and its control in India 1997-98*. Pp 11, 16, 32.

[15] Ibid. Pp 73.

[16] Ibid.

Chapter 4

Baleful ignorance

Poly Chlorinated Biphenyls

Officially, Poly Chlorinated Biphenyls (PCBs) are no longer manufactured or used for electrical equipments in India. The status of manufacture and use of PCBs or their brominated cousins as flame retardants or plastic additives is not known.

Quantity of PCBs in the country

Preliminary survey conducted by the World Bank in 1996 places the estimated quantity of PCBs present in India to be in the range of 2000 to 4000 tonnes, which includes PCBs contained in government and privately owned transformers and capacitors.[1] Currently, Indian Toxicological Research Centre in Lucknow is preparing an inventory on PCBs in India. According to the World Bank Report[2], "the most significant problems appear to be from transformer oils which are present in relatively large quantities. The total quantity of PCBs as transformer oils, probably of the order of 300-500 tonnes is from power industry. The actual quantity of material to be disposed off could be several times this amount, as the equipment is decommissioned. There is probably a similar quantity of PCBs from other industrial sources, of which the steel industry was referred to by several people."

The power sector represents 50 per cent of PCB holding in the country, followed by substantial amounts of PCBs in the steel industry, particularly plants using Russian technology.[3] According to the investigation conducted by the World Bank, as stated in their Report, of power industry:

- "Maharastra State Electricity Board have identified three sites which have PCB filled transformers.
- Tata Electric Companies have several hundred (200-300) PCB containing capacitors and have constructed a sealed concrete vault to store 136 capacitors removed from service.
- Bombay Suburban Electric Supply Ltd. has some PCB containing capacitors, those removed from service are stored in an "outdoor scrap yard."
- There are 34 transformers at the Badarpur plant operated by the National Thermal Power Corporation. Some transformers have been taken out of service but plans for PCB management are not advanced.
- Power Grid Corporation of India has tested transformers oils for PCBs but has not found significant concentrations (<0.5 ppm)."

After transformers, capacitors are main source of PCBs. But it is difficult to estimate the amount of PCBs in capacitors because of its dispersed nature. An electricity distribution system may have 300-500 capacitors, which may contain PCBs (each capacitor contains a few kgs of PCBs and is sealed inside the steel shell), as in the case of BSES and Tata in Mumbai. According to Bharath Heavy Electrical Limited), India's primary public sector equipment manufacturer, there is approximately 1000 tonnes of PCBs from capacitors in the country. Assuming that there is an equivalent amount of PCBs outside the power industry, the total amount of PCBs in the country will be 2000-4000 tonnes.[4]

Regulations

India does not have any specific legislation to regulate PCBs disposal or technologies to destroy PCBs. The two main regulations which could be relevant to the management of PCBs are:

- Hazardous Wastes (Management & Handling) Rules 1989; and Manufacture, Storage and,
- Import of Hazardous Chemicals, Rules 1989.

There is no specific listing of PCBs in any of the rules and the general toxicity criteria only include some forms of PCBs. Like disposal of over 50 kgs of halogenated hydrocarbons per year is regulated under these Rules. According to the Ministry of Environment and Forests, as stated in a World Bank Report [5] "PCBs are not formally regulated in India nor are they banned from use. The relevant regulations are the 1989 Rules to the Environment (Protection) Act ...it was (is) unlikely that PCB regulation would become a high priority in the near future." The MoEF officials claim that PCBs have not been in use since 1965 whereas Ministry of Chemicals and Petro Chemicals claim to have banned the use, manufacture and import of PCBs since 1990. With such conflicting claims from concerned government agencies the status of PCB regulation in the country still remains unclear.

Disposal of PCBs

In India, there are no guidelines or technologies prescribed for disposal/destruction of PCBs. According to the MoEF "Transformers that have been decommissioned may have been sold to scrap dealers who may have drained the oil without realising the content. As a result PCB oil could have been discharged into the environment or mixed with other oils." Also MoEF added that in case of incidents of fire at electrical installations, PCBs might have been released into the atmosphere.[6]

The actual volume of PCB containing material to be disposed is much higher than the actual amount of PCB present. Proper decommissioning of a transformer requires multiple washing and flushing of the metal components, thus increasing the volume of contaminated liquid by approximately three times. Capacitors usually contain PCBs soaked into packing material, which makes drainage of the capacitors unfeasible. Therefore, storage and

destruction/disposal of PCB oil in capacitors would actually mean disposal of the total capacitor, that is almost ten times the actual amount of PCBs present in a capacitors.[7] Given that most of the equipment supplied between 1961 and 1982 may now be coming up for decommissioning is particular cause for concern.

The World Bank report gives a few recommendations for disposal of PCBs that are short sighted and fraught with danger. Some of the recommendations include: high temperature incineration, combustion in local furnaces or boilers, local use of cement kilns, landfill disposal.

Indian studies on the PCBs levels in the environment

- Industrial sources of PCBs as a by-product of chlorine chemistry are also likely to be a significant contributor to PCBs in the environment in India. A December 1999 Greenpeace report titled "Toxic Hotspots: A Greenpeace Investigation of Gujarat Industrial Estates," identifed the presence of several PCB congeners and hexachlorobenzene in treated and untreated wastewater and effluent treatment plant sludge from the chemical industrial estates of South Gujarat.
- A 1995 study by Kannan, Tanabe et al[8] reports a mean concentration of 3.5 parts per billion (wet weight) in marine fish taken from India. Another study[9] from South India done in 1988-89 found between 0.66 and 7.1 ng/g wet weight of PCB residues in mussels.
- In a study done by Prof A.K. Bhattacharya of Jawaharlal Nehru University levels of PCBs were detected in Najafgarh Drain, which passes through Delhi and eventually meets Yamuna.

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[1] The World Bank. 1996. *Management of PCBs-India.* By Sinclair KnightMerz Pty Ltd. Australia. Pp 31.

[2] Ibid.

[3] Ibid.

[4] Ibid.

[5] Ibid. Pp 29.

[6] Dr. R.R. Khan. Ministry of Environment & Forests. Personal Communication.

[7] Ibid note 1.

[8] Kannan, K., Tanabe and Tatsukawa, R. (1995) Geographical distribution and accumulation features of organochlorine residues in fish in tropical Asia and Oceania. Environmental Science and Technology 29: 2673-2683.

[9] Ramesh A., Tanabe S., Subramaniyan A.N., Mohan D., Venugopalan V.K. and Tatsukawa R. (1990). Persistent Organochlorine Residues in Green Mussels from Coastal Waters of South India. Marine Pollution Bulletin Vol. 21 (12). Pp. 587-590.

Chapter 5

Unseen devils

Dioxins and Furans

Currently, no data exist on the levels of dioxins and furans in India. Neither is there any substantial legislation that addresses the threat of dioxins. The Biomedical Wastes (Management and Handling) Rules of 1998 and the recently notified Municipal Solid Wastes (Management and Handling) Rules, 2000 are the only rules that attempt to address, albeit inadequately, the possible emission of dioxins from incinerators. The Rules prohibit the burning of chlorinated wastes and PVC plastics in medical and municipal waste incinerators. However, in the absence of labelling requirements for plastics, the usefulness of this aspect of both the Rules is limited.

But lack of hard data regarding the presence of dioxins, furans and other POPs in India does not mean the absence of a problem. Research into the distribution and abundance of POPs in the Indian environment would provide useful additional data to those which already exist in other parts of the world, but such research is not a precondition to the need to identify and eliminate sources of dioxin. The need for such action is already clear. The only question remaining is how a dioxin elimination programme could be most effectively implemented in India. Development of such a programme should include the drawing up of a definite timetable for the achievement of the elimination target.

Potential Sources of Dioxins/Furans in India

- Medical Waste Incinerators
- Open Burning of Domestic Wastes
- PVC manufacturing (7,80,000 MT)
- Chlorine-bleach Pulp and Paper Mills (3.022×10^6TPA)
- Mono-, di-, tri-, tetra- and pentachlorophenol manufacturing (pre-cursors/ indicators of dioxins and furans
- Manufacturing of pesticides such 2,4-D
- Manufacture of other chlorinated chemicals
- Hazardous Waste Incinerators
- Thermal Power Plants (coal combustion)

Dioxin Indicators

Environmental analyses conducted by Greenpeace International between 1996 and 1999 for pollutants in various environmental media around industrial areas revealed the presence

of chemicals which may be considered to be pre-cursors or indicators of dioxins and furans, including di- and tri-chlorophenols and hexachlorobutadiene. Chlorophenols were found in the 1996 analysis[1] of pulp mill effluents from Seshasayee Paper and Board Mills, Tamilnadu, Ballarpur Mills, Yamunanagar, and Central Pulp Mills, Gujarat. Hexachlorobutadiene was found in sediment samples taken in 1996 from Chemplast Sanmar, Mettur, Tamilnadu.

In India the Chlor-alkali industry is a major source of chlorine. The annual production from the chlor-alkali industry is 1.41 million tonnes, though the installed capacity is 2.1 million tonnes[2]. There has not been much effort to document the pollution from chlorine based industries. One of the major reasons for this is the varying size of the units and their diverse production processes.

Toxics Link chose to study four industrial activities which are potential sources of Dioxin, Furans and other POPs: the paper and pulp industry, dyes and intermediate industry, Poly Vinyl Chloride (PVC) industry and incinerators.

These were chosen because of:

- the use of chlorine in their manufacturing process, and
- their technical processes release some of the persistent organic pollutants.

In the developed world many of these industries are at sunset and hence, they are now finding a new life in developing countries such as India because of the lax environmental regulations. The definition of industrial processes in this context is not only confined to those related to manufacture; industrial processes include technologies or processes that are used to manage waste and/or generate power/electricity.

The Persistent Organic Pollutants that are formed in the industries that were surveyed were dioxins, furans and PCBs. The table below provides information on the industry and the types of POPs formed.

Paper and Pulp industry

Paper production in India is distributed into a few large paper industries and many small-scale paper manufacturers. The small-scale sector provides approximately 48 per cent of India's paper needs. The risk of pollution is higher in the small-scale sector as the technology used is obsolete. However, the large-scale manufacturers too, use technology that is outdated and polluting. A major reason for the use of outdated technology is the lack of proper pollution control norms, regulations and enforcement.

Process used in Indian mills

According to the Central Pollution Control Board (CPCB) " All existing mills in the country

Table I: Industry and types of POPs

Type of industry	Capacity	Inputs	Process	Types of POPs formed	Estimate of POPs production
Paper and Pulp	3.022×10^6 (TPA)	Chlorine	C-E-H-H	di and tri cholorophenols (precursors to dioxins, furans) Dioxins, furans	Release to land (not by incineration)- 24 gms/ 86,000 MT/day Release in waste water - 20 gms/ 86,000 MT/day Release in products - 25 gms/ 86,000 MT/day[3]
Dyes and intermediates	55,000 tonnes (only in organised units)	Chlorine	No data	No Data	Currently no data available
Poly Vinyl Chloride	7,80,000 MT	Chlorine	Direct Chlorination & Oxychlorination	Dioxins and furans	An EDC/ PVC plant could produce up to 400 grams TEQ (toxic equivalents to the most toxic dioxin) per 100 000 tons of EDC produced[4]
Incineration (municipal and hospital)		Chlorinated plastics and other chlorinated matter	Combustion of chlorinated materials	Dioxin, furans and PCBs	**For municipal waste incinerator only** No calculation of emission to air. But in ash TEQ levels range from 106 ng/ kg to 466 ng/kg with a mean value of 258 ng/kg. The fly ash has higher contamination levels 13,000 ng TEQ/kg[5]

are based on chlorine bleaching——,"[6]. However there are a few units which are moving away from the use of elemental chlorine.

Sources of POPs in the manufacture of pulp

The process of extraction of cellulose from cellulosic material require the use of chemicals and more so in the bleaching process. Chlorine is a powerful oxidising agent and has been traditionally used in the first stage of bleaching of pulp. This is due to its ability to selectively attack lignin and make it soluble for extraction[7].

Chlorine, for industrial purposes, is produced by the electrolysis of salt water. The process forms Sodium hydroxide (NaOH) (Caustic Soda, Hydrogen and Chlorine). Since the paper mills require both chlorine and caustic soda, the two are bought together, as it is the cheapest way. The use of chlorine in the bleaching process, however, produces approximately 1,000 organochlorine pollutants[8]. Organochlorines are formed as a result of the reaction of chlorine with the organic chemicals present in the pulp.

According to a Greenpeace report[9], "elemental chlorine reacts primarily with resident lignin to produce approximately 4 kg of organically bound chlorine per tonne of pulp produced. This figure, however, will vary according to the 'kappa number'. A number of chlorinated phenolic compounds form part of this release".

The report further goes on to state, "Chlorinated phenols are precursors of polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs)." The report quotes a study conducted on a pulp industry in North America where it was found that in bleached Kraft pulp samples, 2,3,7,8-TCDF and TCDF were found at levels ranging between 1-52 parts per trillion (ppt) and 1.2-330ppt. Levels in the final effluent ranged between 3-120 parts per quadrillion (ppq) for TCDD and between 7-2,200 ppq for TCDF. A study of a pulp plant using chlorine, consisted a list of over 250 chemicals present in mill effluents. 180 of these were chlorinated compounds.[10]

According to Mr. N K Thusu, President-Operations Orient Paper and Industries Ltd., "About 90 per cent of the chlorine used in the pulp bleaching process reacts to produce sodium chloride (NaCl), non toxic inorganic compound. A very small part of the remaining 10 per cent forms chlorinated molecules that are toxic, persistent and bioaccumulate."[11]

Analysis of pulp mill effluent from three Indian mills – the Central Pulp mills (Gujarat), Bellarpur mills (Yamunanagar) and Seshasayee Paper and Board Mills (Tamil Nadu) found large quantities of di-and tri-cholorophenols.[12] These chemicals are often considered to be indicator for the presence of polychlorinated dibenzodioxins and dibenzofurans[13].

Paper production scenario in India

There are 380 paper mills registered in India with a total capacity of around 3.8 million tonnes. But the numbers are incomplete since the mills with capacity less than 5 lakh tonnes do not have to formally apply for a license. Therefore, if the unregistered mills are taken into account, the numbers can go above 800 mills[14]. The paper industry is highly

scattered with capacities ranging from 5 tonnes per day (tpd) to 600 tpd. Of the total installed capacity, 43 per cent is dependent on forest-based inputs, 28 per cent on agro-based inputs and the rest on other materials including secondary fibre.[15] The consumption of paper has increased from 1.19 million tonnes per annum (tpa) to 2 million tpa in the 80's, in the early 90's there was negative growth. The growth rate is assumed to be 6 per cent per annum if the GDP growth is taken at 5 per cent.[16] (see annexure 7.5)

Table 2: Paper and Board Production and Consumption[17] ('000 tonnes)

Production	1992	1993	1994	1995	1996	Annual 91/96	% change 95/96
No. of mills	327	330	340	380	380		
Installed capacity	3300	3400	3460	3800	4200		
Capacity utilisation	71.5	75.2	78.4	82.0	75.4		
Production							
Total	2359	2557	2712	3117	3169	5.7	1.7
Consumption							
Total	2532	2833	2977	3388	3501	6.6	3.3
Imports							
Total	180	283	269	321	382	19.3	18.8
Exports							
Total	7	7	5	50	–	–	
Demand/ Supply gap	173	276	265	271	332		

Incinerators

Complaints of high costs of investments in clean technology provides a good argument for manufacturers to opt for cheaper 'end-of-pipe' solutions. Incineration is one of them. This technology is being propounded as a cure for all the problems of waste generation as it is supposed to convert the waste into 'harmless' ash and smoke.

Focussing on reduction of volume, destruction of material and low costs, incinerator manufacturers have sold many such machines to hospitals and industries.

India does not have standards for operation of incinerators, except for incineration of medical waste provided in the Biomedical Waste (Management and Handling) Rules 1998 and now the recently notified Municipal Waste (Management and Handling) Rules 2000.

Sources of POPs (Medical and Municipal incineration)

Municipal and medical wastes consist of biodegradable waste as well as plastics like PVC and heavy metal contaminated waste. Burning of waste contaminated with chlorinated compounds leads to the formation of toxic compounds like dioxins, furans and poly chlorinated bi-phenyls. These are formed when the individual components of residues recombine in the stack as the fumes cool. In the presence of chlorine, carbon, hydrogen and oxygen, PCBs and dioxins are the most stable compounds that are formed[18].

Technology used in incineration

In India, incineration is rudimentary. Most incinerators in India are single chambered with a smokestack. As mentioned in the introduction, except for the biomedical waste rules, which stipulate that incinerators should be double-chambered with a smokestack of a particular height, other incinerator users do not have any such stipulations.

Even with the Biomedical Waste (Management and Handling) Rules, there have been instances were cities have installed single chambered incinerators for medical waste

Major reasons for dioxin emissions from medical wastes incinerators in India are:

- Almost all of them burn mixed wastes, even if this is illegal.
- Due to lax enforcement and monitoring most of the hospitals are incinerating their plastic waste and also wastes treated with chlorinated disinfectant.
- Many of the incinerators still have single chambers, both in big and small cities, inspite of the Rules stipulating installing double chambers. (Secondary chambers are needed to eliminate volatile substances by better combustion.)
- Most of the incinerators do not operate under stipulated temperature. Under the regulations, primary chambers should operate at 850^0 C and secondary chambers should operate at or more than 1000^0 C.

New emerging threats of dioxin emissions: Waste to Energy from Municipal Waste

An arm of the government, focused on energy production from renewable sources, the Ministry of Non-Conventional Energy Sources (MNES), Government of India, has set up a

national program for recovery of energy from urban and industrial waste. It has put together an attractive package to promote investment in waste to energy schemes, which essentially includes "mixed wastes burning" projects, which are definite source of dioxin emission. MNES projects a figure of around 1000 MW of potential electricity generation from urban wastes. The primary focus of the Waste To Energy (WTE) program is sought to be shifted from "primitive" composting technologies to state-of-the-art technologies like pyrolisis/ gasification, pelletisation, plasma arc, all essentially different forms of incineration process. Foreign trade promotion agencies of Netherlands, Germany, Canada and the United States are eyeing the $270 million worth environmental technology market opened by garbage in India. The technology market share which is currently dominated by composting and biomethanation (80 per cent) is set to change with the expected onrush of US trade. It is expected that burn technologies will take up as much as 20 percent market share within 10 years, at the cost of composting, biomethanation and landfill.

Table 3: List of Waste to energy projects in India (in different stages of progress/ pipeline)

S. No	City	Technology	Capacity
1.	Vijayavada	Pelletiastion/Refuse Derived Fuel (RDF)	20 tonnes/day
2.	Nagpur	Biomethanation	4 MW
3.	Chennai	Gasification	14.5 MW
4.	Hyderabad (started operating)	Pelletisation/RDF	210 tonnes/day
5.	Kanpur	Biomethanation	8 MW
6.	Lucknow	Biomenthanation	4MW
7.	Pune	-	-
8.	Jaipur	-	-
9.	Chennai	Pelletisation	-
10.	Assam	Gasification	10 MW
11.	Bangalore (started operating)	Pelletisation/RDF	-
12.	Chennai	Pelletisation/RDF	5 MW
13.	Delhi	Plasma arc	22 MW
14.	Mumbai (3 projects)	Pyrolysis	-

Poly Vinyl Chloride

Poly Vinyl Chloride (PVC) is a plastic that contains 57 per cent by weight chlorine and 43 per cent hydrocarbon[19]. PVC is the second most commonly used plastic[20]. According to the report titled *PVC - An Environmental Perspective*, "after polyethylene, PVC is the largest volume thermoplastic accounting for around 30 per cent of the world chlorine production. This makes it the single largest end user of chlorine."

POP's production during the manufacture[21 22 23 24]

The process of manufacture of PVC begins as ethylene and chlorine react to form Ethylene Dioxide or Ethylene dichloride (EDC). EDC, through thermal cracking is converted to Vinyl Chloride Monomer or VCM, which is finally polymerised to form Poly Vinyl Chloride or PVC.

There are two methods for the formation of EDC - Oxychlorination and Direct Chlorination

Oxychlorination - In this process, ethylene, hydrochloric acid and oxygen react in the presence of a catalyst (Copper Chloride) to form ethylene dichloride.

Direct Chlorination - Ethylene and chlorine catalysed either by 1,2 dibromoethane or metal chlorides reacts to form EDC. The reaction generates heat and involves various intermediate steps.

The process of creation of EDC and VCM creates 2-5 per cent of chlorinated by-products per tonne of VCM produced. These by-products, known as heavy and light ends, are created in approximately the same amounts.

Dioxins and related compounds are formed in large quantities during the manufacture of EDC/VCM. The quantity formed ranges from 0.5 grams per 100,000 tonnes of EDC to 419 grams per 100,000 tones.

A study of the sediments of the Rhine river showed increased concentrations of Dioxins near a VCM plant. It was estimated that upto 80 per cent of the dioxin content in these sediments was caused by VCM-production.

Copper Chloride used as a catalyst in the Direct Chlorination process contains dioxin in nano grams per kilograms (ng/kg) even in its purest form.

In a study completed on the PVC manufacturing process in an industry in the UK, using the oxyxchlorination process was found to create 625 g ITEC/annum for 110 kT/annum of product.

There are many routes of discharge of dioxin and furans during the process of creation of VCM:

- Direct and diffuse to air, water and ground
- Through heavy and light ends

- Through the different types of waste and residues created during treatment of wastes and catalytic residues.
- The PVC product is contaminated by dioxin too in the ppt TEQ range. (see annexure 7.6)

Table 4: Emission and waste from the production of 1 Kg of PVC averaged over all the polymerisation process[25]

	Emission	Unit	Average
Air Emissions	Chlorine	mg	2
	Chlorinated organics	mg	720
Water Emissions	Chloride ions	mg	40000
	Chlorinated organics	mg	10

POP's production during disposal of PVC

Since PVC is one of the most widely used plastic, it finds its way into the municipal waste stream. Incineration of municipal waste would therefore generate dioxins mainly because of its constituents.

PVC production in India

PVC demand has been growing at a steady pace in India. The demand for this product for the year 1998-99 is expected to be 6.8 lakh tonnes, an increase from 5.8 lakh tonnes in the previous year. Market analysts state that this industry is going to grow by 14 per cent in the next four years till the year 2002. The capacity is estimated to increase to 11.61 tonnes by 2002.[26] (see annex 7.7)

There are seven major companies that produce PVC. They have a total capacity of 8.21 lakh tonnes.[27]

Table 5: Total installed capacity and production[28] **(In '000 MT)**

1997-98		1998-99				1999-2000	
Actual		Anticipated		Estimated		Anticipated	
Installed Capacity	Production	Installed Capacity	Production	Installed Capacity	Production	Installed Capacity	Production
780	679.90	820	750	780	700	780	750

However, data on this industry is not precise, another source gives the annual production of PVC as 0.73 million tonnes with an installed capacity of 0.80 million tonnes. The expansion plans that have been sanctioned amount to 0.45 million tonnes.[29]

Dyes and Intermediates

There was no information available on the technology used for the manufacture of dyes and intermediates at the time this report was compiled. The information collected only pertains to production figures.

Situation in India

The total demand for dyes were expected to cross 46,000 tonnes in 1988-89 according to a 'Fifteen year perspective plan' made by the Indian Chemical Manufacturers Association in 1976. The country is self sufficient in this product with a total installed capacity of 34,963 tonnes in the organised sector.

The definition between unorganised and small sector is not very clear. This can be seen by the distribution provided by the Central Pollution Control Board. According to them, India has approximately 937 units. Of this only 321 units are in the organised sector. The remaining units are in the unorganised sector with a total production of 28,000 tpa.[30] Another source states there are approximately 37 units in the organised sector and 900 units in the small-scale sector. [31]

Table 6: Capacity utilisation of the dyestuff industry[32]

S.No	Year	Capacity utilisation in per cent
1	1970	70.5
2	1980	70
3	1990	83.4
4	1992-93	66.1
5	1993-94	69.2
6	1994-95	73.5
7	1995-96	70
8	1996-97	72

Table 7: Production of dyes and intermediates[33]

(in tonnes)

S.No.	Year	Organised Sector		Production in SSI sector	Total production
		Capacity	Production		
1	1984-85	29500	18412	-	-
2	1985-86	30000	19000	-	-
3	1986-87	36700	20529	10285	30814
4	1987-88	36700	25200	10500	35700
5	1988-89	41500	26200	11000	37200
6	1989-90	43000	28000	12000	40000
7	1990-91	44000	29000	13600	42600
8	1991-92	-	39000	15600	54600
9	1992-93	-	45000	18000	63000
10	1993-94	-	-	-	-
11	1994-95	50000	48000	30000	78000
12	1995-96	55000	50000	25000	75000
13	1996-97	55000	50000	23500	73500

[1] Santillo, D., Stephenson, A., Labounskaia, I., and Siddorn, J. (1996). A Preliminary Survey of Waste Management Practices in the Chemical Industrial Sector in India: Consequences for Environmental Quality and Human Health – Part III: Tamil Nadu. Greenpeace Research Laboratories.

[2] Personnel communication with Chief Editor, Nandini Chemical Journal, 7th June 1999.

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[27] Ibid.

[28] Annual Report, 1998-99, Department of Chemicals and Petrochemicals, Ministry of Chemicals and Fertilizers, Government of India.

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[31] Kothari's Industrial Directory of India 1996-97. Kothari Enterprises. Chennai.

[32] Ibid.

[33] Information provided by Nandini Chemicals, 7th June 1999. Chennai.

Chapter 6

A Dangerous Diaspora

Pesticide loads in the Environment, Humans and Food

The onset of green revolution led to the intensive use of pesticides and fertilizers in agriculture to increase the yields. With unprecedented increase in use of such pesticides, the levels of pesticides started showing in the agricultural products. To regulate the pesticide residue levels, the governments and the international agencies have formulated standards for pesticide residue in different agricultural products depending upon the toxicity.

Among various international standards, CODEX standards are most often quoted which, is a joint FAO/WHO Expert Commission on Food Additives. The Commission prepared certain principles for the determination of the Maximum Residue Limit (MRL) for food items based on [1]:

i. supervised trials designed to determine the maximum residue limit

ii. detailed toxicological studies with parent compound and major toxic metabolites

Maximum Residue Limit (MRL) is the maximum concentration of pesticide residue on crops or food resulting from the judicious use of pesticide (good agricultural practice). In a good agricultural practice, minimum pesticide is used to achieve adequate control and applied in a manner to ensure minimum residue that is toxicologically acceptable[2].

ADI or the Acceptable Daily Intake is the amount of a certain contaminant consumed in a day. The units for ADI are in mg/kg of body weight/day.

Findings

Between 1985 and 1996, a study under the aegis of Indian Council of Agricultural Research "All India Coordinated Research Project on Pesticides" was conducted. It had 17 coordinating centres for collecting samples of agricultural produce, animal feed and milk products to determine the level of pesticide residue in them[3].

DDT and HCH were two of the pesticides, besides others, that were sampled to determine the levels of residue. Some samples were also analysed for Aldrin residues.

Table 1: Number of samples analysed and found contaminated[4]

Product	Pesticides analysed for								
	DDT			HCH			Aldrin		
	No. of samples	No. contaminated	%	No. of samples	No. contaminated	%	No. of samples	No. contminated	%
Vegetables	201	85	42.3	777	447	57.5	114	39	34.2
Whole Milk	458	397@		487	437*	-	-	-	-
Straw	137	127#		137	127$	-	-	-	-
Honey	27	6	27	27	-	-	-	-	-

*** 379 samples above MRL; @ 199 samples above MRL. # mean value Not Detectable below (ND) - 0.35 mg/Kg**

$ mean value ND<0.01 -0.568 mg/Kg

Table 2: Contamination levels of different brands of baby milk powder[5]

Baby milk powder	Centres and pesticide residues (mg/Kg)									
	Himachal Pradesh		Hyderabad		Kerala		West Bengal		Bangalore	
	HCH	DDT	HCH	DDT	HCH	DDT	HCH	DDT	HCH	DDT
Brand 1	3.734	1.470	.578	0.226	0.251	-	0.522	-	0.225	-
Brand 2	1.128	0.839	1.067	0.320	0.243	-	0.494	-	0.013	-
Brand 3	1.886	0.344	0.415	0.042	0.354	-	0.142	-	0.081	-
Brand 4	2.863	0.468	0.458	0.021	0.241	-	0.694	-	0.071	-
Brand 5	3.031	-	0.389	0.054	0.168	-	0.279	-	0.026	-

Another study was conducted by the Indian Council of Medical Research (ICMR) to determine the levels of pesticides in food. The study 'Surveillance of food contaminants in India', began in 1986 and involved many national institutes and universities. The study compared the level of contamination with the standards provided by the Prevention of Food Adulteration Act (PFA) 1954, GOI.

Some of the results are provided in the tables below.

Table 3: Levels of contamination ($mgkg^{-1}$) and estimated dietary intake*(mg/kg body wt/day) of DDT-complex[6]

Details	Rural	Urban	Combined
Number of samples analysed	1057	1148	2205
Number of samples above detection limit	915 (86.65%)	890 (81.86%)	1805 (77.53%)
Number of samples above tolerance limit (PFA Act)	445 (42.10%)	367 (31.97%)	812 (36.83%)
Number of samples above MRL of Codex	445 (42.10%)	367 (31.97%)	812 (36.83%)
Estimated dietary intake			
i. Man	0.00020	0.00014	0.00017
ii. Woman	0.00024	0.00017	0.00021
iii. Child	0.00145	0.00103	0.00128

*** Based on average (of central 90% values) level contamination and vegetarian balanced diet. ADI Codex - 0.02 mg/kg of body weight/day**

Table 4: Levels of contamination ($mgkg^{-1}$) and estimated dietary intake*(mg/kg body wt/day) of apha-HCH[7]

Details	Rural	Urban	Combined
Number of samples analysed	1057	1148	2205
Number of samples above detection limit	937 (88.65%)	980 (85.36%)	1917 (86.94%)
Number of samples above tolerance limit (PFA Act Provisional)	222 (21%)	242 (21.08%)	464 (21.04%)
Number of samples above MRL of FRG	904 (85.53%)	948 (82.58%)	1852 (83.99%)
Estimated dietary intake			
i. Man	0.00010	0.00014	0.00011
ii. Woman	0.00012	0.00016	0.00013
iii. Child	0.00074	0.00101	0.00081

*** Based on average (of central 90% values) level contamination and vegetarian balanced diet. ADI FRG 0.005 mg/kg body wt/day**

Finding in the tables 1-2 give a fair indication of the amount of pesticides that a person consumes either from vegetables or honey. The samples analysed in Table 1 shows that in most cases more than 50 per cent of the samples had pesticide residues. Even animal feed (straw) had such residues.

Tables 3 and 4 not only gives the number of samples that were contaminated but it even gives the amount consumed. What should be noted is that children consume the largest amount of pesticides amongst male and female adults.

Even if the levels are low/or below the values of ADI, we have to keep in mind that these pesticides are absorbed by the fat in the body, and continue to accumulate, till they cause harm.

Pesticide contamination in wheat flour: CERC findings

A recent research conducted by Consumer Education and Research Center (CERC), Ahemdabad, Gujarat, has found that most of the wheat flour brands are contaminated with pesticides and some of which are banned in India for use.

They selected 13 brands and 3 loose wheat flour samples and tested them according to the specifications set by the Prevention of Food and Adulteration (PFA) Act, the Bureau of Indian Standards (BIS), the Agriculture Produce Grading and Marketing Act (Agmark) and Codex Alimentarius- the international standard.

The key findings were:

DDT: This organochlorines pesticide, which was banned in the year 1989 for any agricultural use was found in all the 13 branded samples. DDT is still used for public health purposes for vector control.

Lindane: As stipulated by the PFA Act, lindane should be absent in the wheat flour. Yet it was found that all the branded samples as well as two loose samples has lindane in the range of 0.002 –0.450 ppm.

Aldrin/dieldrin: These two pesticides, banned in India since 1996, was found in two top brands, one of them is a well known MNC from US (Pillsbury).

Ethion: An organophosphate was found in 12 samples, which causes an acute toxicity in humans.

Not only the wheat flour but also the grain samples tested showed the presence of lindane, ethion and malathion. Studies conducted in Punjab, Haryana, Delhi and Mumbai revealed wide-spread contamination of wheat grain with DDT and residues of BHC, which included lindane.

Source: Insight: The consumer magazine, vol.20, no.3, May-June 2000, Consumer Education and Research Center (CERC), Ahemdabad, Gujarat.

Table 5: Comparison of permitted pesticide levels in milk[8]

Pesticides	PFA	German Standards	CODEX
Alpha BHC	.05 ppm (max)	.004 ppm	
DDT	1.25 ppm		.05 ppm

The above table clearly indicates that the Indian standards provide for more contamination of milk than other international standards.

It is not just recently that people have started to wonder about the levels of contamination in food. Since the early seventies, there have been published reports on the levels of pesticide loads on various types of food in India.

All the above mentioned results clearly indicate bioaccumulation, that can reach levels where symptoms are acute. However these pesticides have been known to cause subtle effects to the human body at levels below the acute level. (see annexure 7.9)

Case study: Pesticide exposure in Delhi

Aldrin and Dieldrin

Dieldrin was notified as a restricted pesticide in 1989 whereas Aldrin was completely banned in 1996. During the period of usage, a study was carried out to determine the residues in human fat, milk and blood serum from residents of Delhi[9]. It was found that all samples had levels of these pesticides. The findings are given in the tables below.

Table 6: Levels of aldrin and dieldrin in human adipose tissue, breast milk and blood serum (in ppb)

Human samples	Number	Aldrin range	Dieldrin range
Adipose tissue	12	0.008 - 0.103	0.01 - 0.28
Breast milk	12	0.001-0.01	0.001 - 0.32
Blood serum	12	0.004 - 0.013	0.0001 - 0.0002

The study further adds that mothers who have already borne the first child had lower levels of pesticides in their breast milk while feeding of the second child. This is a clear indication that breast milk is a conduit for passing on the pesticide load from mother to a child. It was also added that older women had higher loads of these pesticides in their breast milk. This becomes a cause for major concern as children are exposed to vast amounts

of pesticides at a very young age. These mothers who were tested for these chemicals could have been exposed to these chemicals by consumption of contaminated animal product or by the use of contaminated water either for drinking or for irrigation.

Another study determined the levels of these pesticides in the ambient environments of Delhi. Soil samples, earthworms and samples from a river were collected. All samples had residues of the pesticides[10].

Table 7: Levels of aldrin and dieldrin in the ambient environments of Delhi

Sample	Aldrin	Dieldrin
Soil	0.0003mmg/g to 0.12mmg/g	0.0002mmg/g to 0.03mmg/g
Water	0.0005mmg/ml to 0.05mmg/ml	0.0001 mmg/ml to0.1 mmg/ml.
Fish	0.0001mmg/g to 0.03 mmg/g	0.0001mmg/g to 0.16mmg/g
Clam	0.0002 mmg/g to 0.01 mmg/g	0.0001mmg/g to 0.047 mmg/g

DDT and HCH

DDT has been in use in India for a very long time. In 1989, it was put on the restricted list. DDT is now used for vector control only. A study[11] was conducted to determine the levels of DDT and HCH in mothers and their children. The study reported:

- The average level of DDT in breast milk, maternal serum and cord serum were 1.27mg/L, 0.27 mg/L and 0.14 mg/L respectively.
- p,p' DDE, a metabolite of DDT was the predominant contaminant in the milk with 53% of the total DDT.
- bb-HCH isomer was the most predominant contaminant, comprising 60% of the various HCH isomers.
- First time mothers showed 1.15 and 2.3 times more DDT and HCH residue in their breast milk when compared to mothers with children.
- This is an indication of bioconcentration and storage of pesticides in breasts of first time mothers from their birth until their first lactation

The study also stated '...the mean total DDT level in breast milk was 1.27 mg/L. Hence, a 3 kg infant consuming 500 ml of milk daily will ingest 0.21 DD/kg/day which is 42 times greater than the recommended 0.005 mg/kg for DDT (WHO 1973)'.

A study[12] of the load of DDT and HCH in Delhi's environment found the following levels:

Table 8: Load of DDT and HCH

Sample	DDT	HCH
Soil	0.02 mg/kg to 0.33 mg/kg	0.001 mg/kg to 0.23 mg/kg
Buffalo milk	0.04 mg/L (mean)	0.003 mg/L(mean)
Human samples		
• Human fat	• mg/kg to 9.1 mg/kg	• mg/kg to 1.9 mg/kg
• Blood serum	• 1.4 mg/ to 12.2 mg/L	• 0.4 mg/L to 2.8 mg/L
Clams	0.06 mg/kg to 2.3 mg/kg	0.02 mg/kg to 0.7 mg/kg
Fish	0.002 mg/kg to 1.38 mg/kg	

The study also provided some interesting details on the levels of these pesticides in humans

- HCH and DDT burden in lower age groups was more than in the upper age groups
- Females had higher concentrations of DDT and HCH than men.

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[2] Ibid.

[3] Ibid.

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Chapter 7

Pilot errors

Alternatives

The whole philosophy of substituting all problems with chemical substances in the early 20th century became a bane for coming generations. The Green Revolution of 1970's, which emphasized only on increased crop production, led to extensive use of fertilizers and pesticides to meet the growing food demand for the ever-increasing population. Similarly to combat resurgence of malaria in 1960's, need was felt to import and manufacture insecticides, especially DDT.

The pesticides were used indiscriminately to counter the pests and the malarial epidemics. The euphoria regarding the success of these chemicals died when:

- Pests started developing resistance not only to one particular pesticide but also to a whole class of pesticides. Pests started showing resistance to even those pesticides which were never used on them before
- The toxicity of these chemicals started threatening the environment,
- Started killing beneficial insects as well,
- These chemicals were found to be persistent and bio-accumulative in nature,
- Evidence of pesticides was found in food commodities and even in the breast milk.

These reasons led the government to explore alternative control methods. These alternative methods lay emphasis on other non-chemical control measures along with pesticides. The bioenvironmental control measures were adopted way back in 1977 with establishment of Malaria Research Centre. The pioneer project was started in Gujarat in the Keda district. And later this approach was adopted in various other places all over India but the desired success was not achieved in all project areas. The reason attributed was lack of community participation.

Public Health Programmes (Vector Control)

Earlier the strategy was based on the two assumptions; viz. insecticidal spraying would kill the vectors or reduce their life expectancy below the levels of development of parasites and drugs would eliminate the parasite from the human reservoir. This strategy was developed without the involvement of community and failed because nine vector species of anopheles developed resistance to DDT and HCH and chloroquine drug in most part of the country[1,2]. Owing to the typical mind set of shifting from one chemical to another, malathion was used

in endemic states, but the vector started developing resistance to malathion as well (Gujarat, Andhra Pradesh and Maharashtra).

The resistance from the community against the indoor sprays due to side effects like, increase in bed bug nuisance and adverse effects on cottage industry such as bee- keeping or silk-culture, became a major problem in rural and peri-urban areas.

These bottlenecks in the conventional vector control methods led to the shift towards bio-environmental control measures. This fact was highlighted by an evaluation committee appointed by the Government of India (NMEP-1985), which said that "*any approach based on continuous reliance on the residual spray as the mainstay of anti-malaria activities will in the end only defeat itself. A strategy aiming at coming to terms with the problem of malaria as it persist today will perforce include a serious problem and sustained effort to develop new means, methods and combination of them, not as pilot or isolated research activities, but as operational trials backed up by professional and popular community supervision. This is especially important with respect to the vector control through environmental manipulation which so far has been conspicuously lacking. What has to be promoted once the eradication approach has been firmly put behind, is the capacity to adopt the interventions and socio-ecological conditions, rather than routine application of standard techniques*".[3]

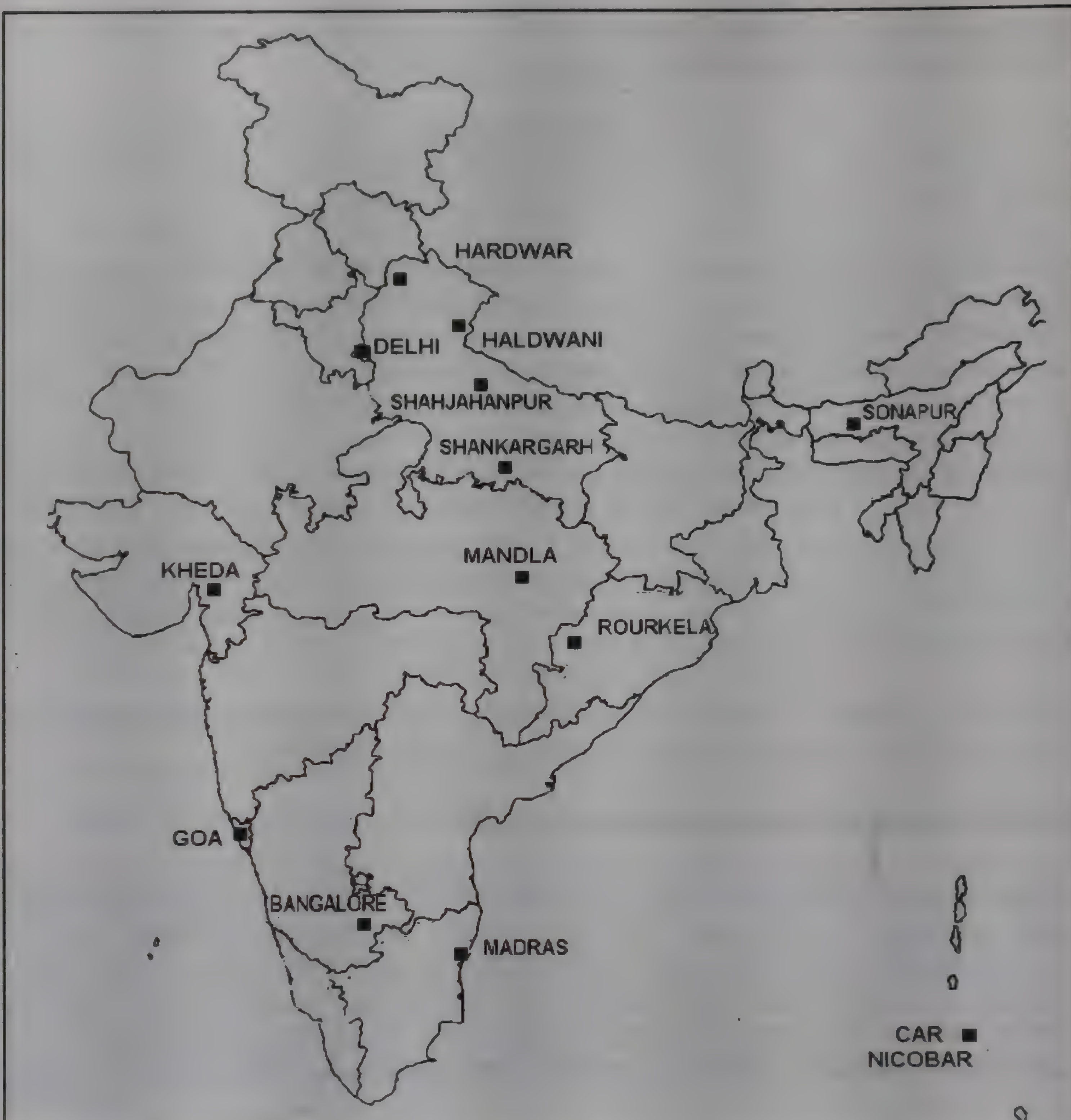
The Malaria Research Center (MRC) established in 1977 with a thrust area identified as research on bioenvironmental control methods for malaria eradication.

Bioenvironmental control measures in India

This alternate strategy for vector control was initially launched in 1983 in 7 villages of Nadiad Taluka in Gujarat. By 1985, the project was extended to cover the entire Nadiad taluka comprising of 100 villages[4]. The demonstration has been tried by Malaria Research Centre at various endemic areas like Nadiad (Gujarat), Dadraul (UP), Haldwani (UP), BHEL, Hardwar (UP), Shankergarh (UP)Bizadandi (MP), Car Nicobar, Sonapur (Assam), Rourkela (Orissa), Hassan (AP), Kollar (Karnataka), Madras (TN), Panjim (Goa) and Bangalore. The Vector Control Research Centre also initiated a similar programme in Pondicherry (see map).

The National Anti Malaria Programme (NAMP) which is the nodal agency for implementation of malaria eradication programme has also started supporting bio-environmental measures. Under World Bank assisted Enhanced Malaria Programme (**see chapter on DDT),** special stress has been given to bio-environmental measures. The emphasis has been laid on the fact, that after five years of project, the community should take-over as the nodal agency to implement this programme further. (see annexure 7.10)

The bioenvironmental measures have to be very specific and based on the proper understanding of local ecosystem and socio-economics of that particular area. In most of



the above-mentioned cases, the reduction of habitat was done; in ponds most of the mosquito breeding was confined to the shallow margins and hoof prints at periphery. In summers, mosquito breeding was encountered in ponds covered with water hyacinth (*Eichornia crassipes*). Hyacinths were cleared off and larvivorus fishes were introduced in the water bodies.

A survey of fish fauna has revealed that there are 14 species of larvivorous fish and the two well-known larvivorous fish are exotic. The guppy (*Poecilia reticulata)*, a native of South

America was introduced in India in 1908[5] and *Gambusia affinis*, a native of Texas was imported from Italy in 1928[6]. These two fish has been widely used in vector control programmes for 5 to 6 decades and now could be found widely occurring in nature almost all over the country. The question on the survival of larvivorous fish in polluted waters, the MRC official said that no fish can survive in polluted water and particularly these two species which are sensitive to pH change.

In recent years, bio-larvicides, eg *Bacillus thuringensis var israelensis* and *Bacillus sphaericus*, have become available for mosquito control. Experience at the MRC has revealed that these bio-larvicides can find applications in a variety of mosquito breeding habitats and can replace chemical larvicides to a very large extent[7]. These measures were implemented with the total participation of community and MRC played a major role by helping people to maintain the hatcheries, providing them with biocides and larvicides.

In some areas, expanded polystyrene beads were used to cover the water surface for reducing mosquito breeding. This is very simple, inexpensive and produces high larval and pupal mortality[8]. This was very effective in controlling mosquito breeding in abandoned wells, biogas plants[9], soakage pits, pit latrines and overhead tanks[10].

Status of bioenvironmental control measures

The various projects that were taken up by MRC went through a slag period as the similar approach was adopted for all the areas. It was successful in Gujarat, Uttar Pradesh, and Karnataka but in Assam, and Orissa these measures didn't show positive result because of the topography and rainfall pattern. According to MRC, the bio-environmental technique was not successful in tribal areas of Madhya Pradesh, Andhra Pradesh and West Bengal, which are endemic to malaria. This was due to lack of co-ordination among various agencies, improper surveillance and infrastructure.

According to Dr. S Subbarao, Director, MRC "political pressure at times lead to injudicious use of pesticides and lack of initiative for the bio-environmental control." As in the case of Sonepat (Punjab), Malathion was used to restrict malaria epidemic but even after the control, the pesticide was continuously used irrespective of request to withdraw because of the political pressure. The outcome of this mismanagement resulted in the development of resistance in vector for Malathion. At times even the pesticide lobby plays a role in promoting the use of pesticides for malaria control as it happened in Panjim (Goa), where the bioenvironmental measures was abandoned to revert back to chemical control because of their vested interests.

Growing vector resistance and limited chemical options (growing resistance to various insecticides) has again given impetus to the bioenvironmental control measures. Even various State Governments are showing interest in this approach and among them Gujarat,

Maharastra and Karnataka have taken initiatives and shown positive results for vector control. State of Karnataka has incorporated this approach in their malaria control programme and in the Kollar district it has shown positive results.

According to Dr. S. Subbarao, bioenvironmental control measures should be very local and focal and community participation is vital in the success of this programme. The task of controlling vector becomes very easy in places where habitats are limited and there is co-ordination among various agencies. During malarial epidemic, the bio-control measures are not sufficient but in such instances, pesticides are used to check the disease.

A case study of Delhi

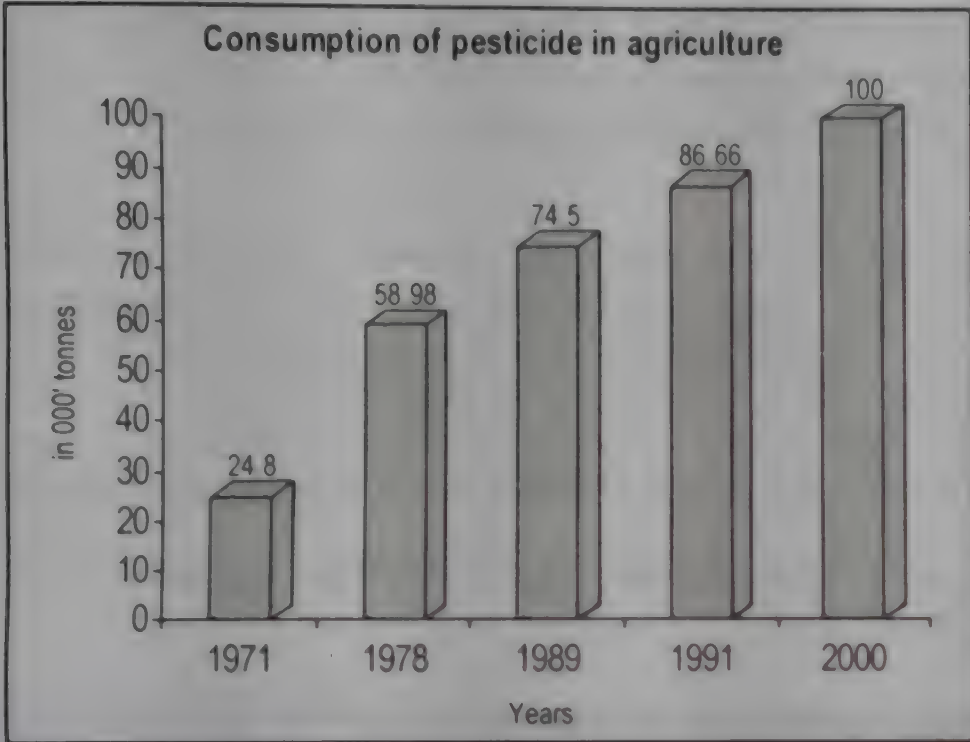
In 1983, Delhi was taken as a demonstration project but later as per the recommendations of the Science &Technology project review committee, work on bio-environmental strategy was taken up for the entire city of Delhi. Geographical reconnaissance of water bodies that support mosquito breeding and also vector population & parasitological data was collected for Delhi to develop methodology related to mosquito breeding. Two civic agencies, Municipal Corporation of Delhi (MCD) and New Delhi Municipal Corporation (NDMC) are implementing the bioenvironmental control measures along with the chemical control.

Larvivorous fish were introduced in 110 water bodies and bio-larvicides such as *B. thuringensis* and *B. sphaericus* was applied to control mosquito breeding in different habitats. Number of personal protection methods was also tested to prevent the man-mosquito contact[11] in the neighbouring rural areas. Series of health education material was also prepared and the awareness programmes were shown on television.

This was an ambitious project but didn't take off as well as it was planned. There is no information on the status of various activities that were undertaken earlier. Neither is there any inventory on the number of sites where larvivorous fish were introduced and their survival rate. According to MRC, the implementing agencies didn't show interest as chemical control is much easier and results are instant. MCD official, Mr. P.K. Sharma said that due to the lack of manpower they were not able to spray biocides and it caused itching in those people who use to spray it. He further added, "earlier 70 – 80 per cent success was achieved by the chemical pesticides but with biocides the success rate was only 20 – 30 per cent." At present, pesticides are used in controlling vector and bioenvironmental control measures are abandoned by the implementing agency.

Agriculture

In India, the pest control practices with pesticides started with the invention of insecticidal properties of DDT in 1939 and its commercial availability in 1940. Its use was curtailed due to high residual toxicity and with the introduction of organophosphorous and carbamates in late 60s. In 1970's, the synthetic pyrethroids were brought to control pest population and the



misuse and abuse of insecticides in pest control led to the problems of resurgence, resistance and secondary pest outbreak.

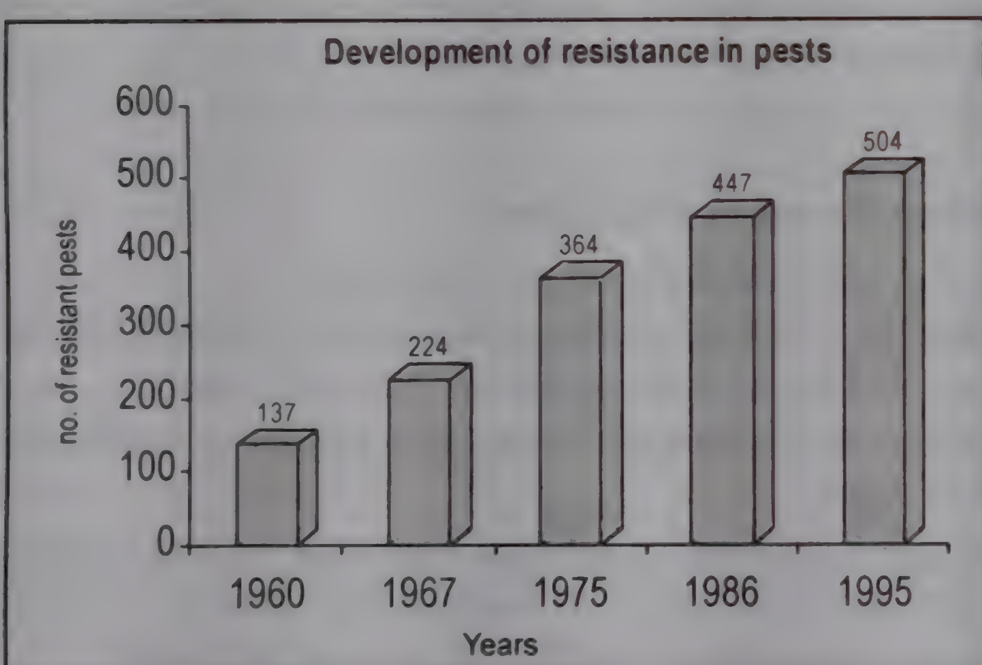
The growing use of pesticides over the years has been shown in the above figure.

There is no "perfect pesticide" which kills only pests and is not toxic to anything else. Only a small fraction, less than 1% of the known species are harmful and over 90% are useful[12]. The use of pesticides affects all kinds of life whether useful or harmful resulting in environmental imbalance.

Though various pesticides were being used in the pest control, but the number of pests increased with the increased use of pesticide. Some of the pests started showing resistance to the pesticides.

Integrated Pest Management

IPM is the modern concept of environmentally sound and sustainable strategy for pest control. In 1967, Food and Agriculture Organisation of the United Nations panel of experts defined IPM as "A pest management system that in context of the associated environment and the population dynamics of the pest species, utilises all suitable techniques and methods in as compatible a manner a possible and maintains the pest population at levels below those causing economic injury".



The Indian Government adopted the concept of IPM way back in 1990 and gave stress on this concept after it was included in Agenda 21 of

UNECD at Rio de Janeiro. To promote the concept, Government of India stopped the subsidy on pesticides and the money was diverted towards the IPM. The National Centre for Integrated Pest Management (NCIPM) and all the agricultural university now have a separate department on IPM.

The concept of IPM has not taken off very well even after 10 years. There are very few places where this approach is used. With input from NCIPM, it is being experimented in Haryana and Maharashtra (cotton). According to Dr. R.N. Singh, Director-NCIPM, the reluctance on parts of farmers to use this concept is due to various difficulties faced by them as it is integrated and a very slow process. There is assistance given to the farmer during the transition period when it affects the crop yield thus affecting farmers economically.

There are few projects in Maharashtra, where organic farming has been successful but is managed by groups and co-operatives.

Problems associated with implementation of bioenvironmental measures

- It is an integrated and inter-sectoral approach and negligence on part of any one agency brings down the whole system.
- It is a very localised approach and differs from area to area, therefore no standard strategy can be followed.
- In case of areas where chemical insecticides are already being used, the same results from the biocides are not achieved.
- Though it is cost effective in the long term, the initial cost of implementation is very high.
- Results with chemical insecticides come very fast but with bioenvironmental approach result start showing after a long period.
- This is very labour intensive and requires full support of the community and with withdrawal of implementing agency, the whole system collapse.
- There is lack of initiative and will among the implementing agencies.

The benefits of bioenvironmental control measures

- This is long term strategy and is beneficial to the surrounding areas.
- In cases of resistance developed by vectors, the bio-environmental control measures are very effective.
- It is an income generating activity for the villagers, thus helps in motivating community to participate in the various activities.
- This helps in reducing the total dependence on insecticide use and to shift to ameliorative measures.
- This raises awareness among people towards vector control, its need and benefits.

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[3] Sharma, V.P.(ed). 1993. *Malaria Control: Bioenvironmental Methods and Community Participation, V.P.Sharma,* in Community Participation in Malaria Control

[4] Sharma, V.P. and R.C. Sharma (1986). Cost effectiveness of bioenvironmental control of malaria in kheda district of Gujarat. Indian J.of Malariology, 23 (2): 141-145.

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Annex 7.1

Lacunae in The Insecticides Act, 1968

In 1989, a letter addressed by an individual, Dr Ashok, to the Chief Justice of India indicating that several insecticides, colour additives and food additives, which are widely used in developing countries are banned in western countries owing to their carcinogenic nature. His letter originally contained list of 21 chemicals & additives and latter 19 more chemicals were added taking the total upto 40. The Court treated this letter as a Public Interest Litigation under Article 32 of the Constitution.

The Court issued notices to the Union of India through the Secretary, Ministry of Environment and Forest, Ministry of Health, Ministry of Agriculture, Ministry of Industry & Chemicals as well as Pesticide Association of India to file counter affidavits. A notification dated 26th May, 1989 indicated that a committee has been setup by the Ministry of Agriculture to review continuance of the use of pesticides that are either banned or restricted for use in other countries. On examining the counter affidavits filed by different Ministries, the Court felt that there is lack of co-ordination among various Ministries involved in this matter and that there has been no continuous research to obtain even the minimum information about the adverse effects of use of such pesticides and other chemicals.

Regarding 40 chemicals the Court agreed on the various steps taken by the Government to ban and restrict the use of pesticides. The Court also directed a formation of Committee of Four Senior officers from four different Ministries and asked them to take suitable measures in future in respect of any other insecticides and chemicals.

Another petition filed by the M/s Kanoria Chemicals and Industries in the Supreme Court, challenging the cancellation of Registration Certificate for BHC under the Notification dated 1st January 1996 issued by the Ministry of Agriculture. The Court passed an order saying that Certificate of Registration granted to the petitioner in respect of any formulations namely BHC 10% DP and BHC 50% WP, the order of the Central Government regarding cancellation is well within the jurisdiction. But in respect of BHC (technical grade) which is one of the substances specified in the schedule of the Act, the Central Government does not have any power to cancel the Certificate of Registration (sub-section (2) of section 27).

The Court observed that once a substance is registered under the Section 3(e) (i) of the Act, then there is no power for cancellation of the registration. "Even if, there are scientific studies to prove that the substance is grossly detrimental to human health. This is the lacuna in the legislation itself and therefore steps should be taken for appropriate amendment to the legislation."

(Source : AIR 1997 SC 2298, S.C. Agrawal and G.B. Pattanaik, JJ,Dr. Ashok v. Union of India & Others)

Annex 7.2

Disposal technologies for date expired pesticides

Recommended by an expert Group constituted by the Union Department of Agriculture and Cooperation, Government of India

Major Recommendations

1. Methodology

i. The stocks of date expired/banned pesticides in general belonging to carbamates, organophosphates and pyrethroids groups can be allowed to be incinerated in an appropriate incinerator with emission control equipment or in an appropriate cement kiln. Organochlorine pesticides can also be disposed off in an appropriate cement kiln. In such cases, the emission standards laid down by the state pollution control boards shall be complied.

ii. The stocks of inorganic date expired/banned pesticides and other categories of pesticides which cannot be disposed off through incineration or cement kiln may be disposed off in secure landfill in identified sites which have been notified by the State Governments.

2. Modalities

i. The stocks of the date expired/banned pesticides may preferably be sent back to the concerned manufacturers if they have the facilities for destruction through incineration or secure landfill. The disposal or destruction should follow the manifest system as per the Guidelines for Management and Handling of Hazardous Wastes, under the Environmental (Protection) Act, 1986.

ii. Wherever the secure landfill facilities are not available with the State Govt./UTs, the neighbouring State Govt./UTs may be approached for extending their facility. The number of sites identified so far in various States are; Andhra Pradesh (1), Bihar (2), Gujarat (15), Haryana (2), Madhya Prasdesh (3), Uttar Pradesh (4), West Bengal (1) and Rajasthan (1). However, 6 sites have been notified in Gujarat, 3 in Madhya Pradesh and 1 in Uttar Pradesh. The expenditure on transport, disposal etc., however, would be borne by the concerned agency/state/UT.

3. Time frame

All the date expired/banned pesticides may be disposed off within a time frame of two years from the date of expiry. For those pesticides lying in stocks for many years with the various States/UTs/individuals, such States/UTs individuals, should finalise a definite time bound action plan for disposal. The submission of action plan for disposal should

not exceed one year and the period for disposal/destruction should not go beyond three years, after the submission of the plan. In such cases, the occupiers of banned pesticides shall obtain authorisation under the Hazardous Waste (Management and Handling) Rules under Environment Protection Act, 1986.

4. Monitoring of disposal operations

Entire process of disposal operation of date-expired/banned pesticides shall be monitored by the respective State Pollution Control Board, and the Central Pollution Control Board in coordination and in consultation with the concerned manufacturers of the pesticides and the various agencies with whom such pesticides are lying. The State Departments of Agriculture/ Horticulture/ individuals, where such pesticides stocks are lying, shall work out a practical and feasible programme for disposing their stocks in a time-bound manner.

B. Other Recommendations/suggestions

1. Wherever larger quantities of date-expired non-chlorinated pesticide are lying in stock especially in the states of Maharastra, Himachal Pradesh, Jammu & Kashmir, Orissa, Uttar Pradesh, and no common facility for identification and notification of sites has been developed by any of the States/UTs. (except Uttar Pradesh), expeditious development of sites in these states/UTs is needed. Signing of MoU for development of such sites as is required under the Environment (Protection) Act may also be given priority by these States/UTs.
2. A precise planning may be required by the State Agriculture/Horticulture Departments and other agencies for working out the requirements of pesticides to avoid piling of stocks of pesticides. This will go a long way in solving the problem of accumulation of pesticides.
3. The State Departments of Agriculture/ Horticulture may identity the incinerators/ cement kilns for disposal of date expired/ banned pesticides. They may also assign the responsibility for taking over the stocks of date-expired/banned pesticides for disposal to the identified incinerators/ cement kilns and provide them the guidelines/instructions for safe disposal.

Note : The recommendations are short sighted and fraught with dangers. Given the fact India does not have emission standards for hazardous wastes incinerator, cement kilns, nor does it have prescribed standards for secure landfills, these recommendations would create more toxic pollution rather than abating them.

Annex 7.3

State-wise per cent distribution of malaria cases during the year 1998[1]

State/Union Territories	Total malaria cases in per cent
Andhra Pradesh	10.60
Arunachal Pradesh	13.27
Assam	23.88
Bihar	0.99
Goa	23.50
Gujarat	36.12
Haryana	82.62
Himachal Pradesh	73.06
Jammu & Kashmir	41.61
Karnataka	39.65
Kerala	9.99
Madhya Pradesh	2.33
Maharastra	18.80
Manipur	25.03
Meghalaya	21.74
Mizoram	8.02
Nagaland	29.17
Orissa	18.43
Punjab	80.76
Rajasthan	71.17
Sikkim	60.53
Tamil Nadu	13.94
Tripura	37.27
Uttar Pradesh	19.97
West Bengal	42.80
Delhi	37.91
Pondicherry	20.95
Andaman & Nicobar Islands	16.77
Chandigarh	66.12
Dadra & Nagar Haveli	48.16
Daman & Diu	41.15
Lakshadweep	0.00

Annex 7.4

State-wise breakup of DDT (50 per cent) consumption for public health, 1998-99 to 1999-2000 (in MT)[2]

S.No.	Name of the State/Union Territories	1998-99 Qty. (in MT)	1999-2000 Qty. proposed for allotment (in MT)
1.	Andhra Pradesh	130	250
2.	Arunachal Pradesh	100	100
3.	Assam	1050	850
4.	Bihar	500	400
5.	Goa	-	-
6.	Gujarat	-	-
7.	Haryana	-	-
8.	Himachal Pradesh	30	40
9.	Jammu & Kashmir	45	50
10.	Karnataka	100	50
11.	Kerala	-	-
12.	Madhya Pradesh	207	728
13.	Maharastra	-	-
14.	Manipur	250	100
15.	Meghalaya	150	116
16.	Mizoram	100	100
17.	Nagaland	100	100
18.	Orissa	300	230
19.	Punjab	150	100
20	Rajasthan	1750	1100
21.	Sikkim	10	10
22.	Tamil Nadu	-	-
23.	Tripura	250	200
24.	Uttar Pradesh	300	250
25.	West Bengal	250	200
26.	Delhi	-	-
27.	Pondicherry	1	1
28.	Andaman & Nicobar Islands	20	20
29.	Chandigarh	7	5
30.	Dadra & Nagar Haveli	-	-
31.	Daman & Diu	-	-
32.	Lakshadweep	-	-
	Total	**5800**	**5000**

Note: The quantity of DDT allotted to each state depends upon the vector susceptibility to the insecticide. Rajasthan has highest DDT consumption because of lower vector resistance (i.e. higher vector susceptibility) to DDT.

Annexe 7.5

Chemicals used in the bleaching process[3]

S.No.	Oxidant	Form	Function	Advantages	Disadvantages
1.	Chlorine and extraction		Oxidize and chlorinate lignin	Effective, economical delignification. Good particle remover	Can cause loss of pulp strength if used improperly. Organochlorine formation.
2.	Hypochlorite (H)	NaOCl	Oxidize, brighten and solubilize lignin	Easy to make and use	Can cause loss of pulp strength if used improperly. Chloroform formation.
3.	Chlorine dioxide	Solution in water	1. Oxidize, brighten and solubilize lignin 2. In small amounts with Cl2 protects against degradation of pulp	Achieves high brightness without pulp degradation. Good particle removal	Must be made on site. Expensive. Some organochlorine formation.

Growth of paper industry in India (installed capacity) in TPA[4]

Year	Number of mills					Total number of mills	Installed capacity
	>20,000	10-20,000	5-10,000	2-5000	<2000		
1951	2	3	2	5	5	17	137
1961	6	4	3	8	6	27	410
1971	14	3	7	12	10	46	901
1979	19	6	23	27	31	106	1530
1980	21	8	24	31	33	121	1538
1981	22	9	31	33	41	136	1657
1982	22	10	40	41	44	157	1816
1983	23	11	41	49	51	175	1907
1984	23	11	60	65	61	220	2165
1985	23	15	68	80	63	249	2350

Demand-Supply Scenario in the Paper Industry[5] **(mn tonnes)**

Year	Demand	Supply	Surplus
1991-92	2.21	2.24	0.04
1992-93	2.31	2.50	0.19
1993-94	2.43	2.63	0.20
1994-95	2.55	2.70	0.15
1995-96	2.67	2.92	1.25

New entrants in the paper and pulp manufacturing business[6]

S.No	Company	Amount	Type of paper
1.	Indo - Gulf Fertilisers	150,000 TPA	Writing and printing paper, and newsprint
2.	Larsen and Toubro	100,000 TPA	–do–
3.	Balajee Steel	90,000 TPA	Writing and printing paper
4.	Sterlite industries	50,000 TPA	Coated and writing and printing paper
		75,000 TPA	Newsprint

Annex 7.6

Emissions and waste from the production of 1 Kg of VCM based ten operation plants[7]

	Emission	Unit	Average
Air Emissions	Dust	mg	2500
	Carbon monoxide	mg	2000
	Carbon dioxide	mg	1288000
	Sulphur oxides	mg	7600
	Nitrogen oxides	mg	11000
	Chlorine	mg	1
	Hydrogen Chloride	mg	160
	Hydrocarbons	mg	15000
	Metals	mg	2
	Chlorinated organics	mg	405
Water Emissions	COD	mg	520
	BOD	mg	30
	Acid as H +	mg	130
	Metals	mg	140
	Chloride ions	mg	33000
	Dissolved organics	mg	700
	Suspended solids	mg	1500
	Oil	mg	40
	Dissolved solids	mg	240
	Other Nitrogen	mg	2
	Chlorinated organics	mg	3
	Sulphate ions	mg	3800
	Sodium ions	mg	1600
Solid Waste	Industrial waste	mg	1000
	Mineral waste	mg	45000
	Slags and ash	mg	8000
	Inert chemicals	mg	7000
	Regulated chemicals	mg	4000

Emission and waste from the production of 1 Kg of PVC averaged over all the polymerisation process[8]

	Emission	Unit	Average
Air Emissions	Dust	mg	3900
	Carbon monoxide	mg	2700
	Carbon dioxide	mg	1944000
	Sulphur oxides	mg	13000
	Nitrogen oxides	mg	16000
	Chlorine	mg	2
	Hydrogen Chloride	mg	230
	Hydrocarbons	mg	20000
	Metals	mg	3
	Chlorinated organics	mg	720
Water Emissions	COD	mg	1100
	BOD	mg	80
	Acid as H +	mg	110
	Metals	mg	200
	Chloride ions	mg	40000
	Dissolved organics	mg	1000
	Suspended solids	mg	2400
	Oil	mg	50
	Dissolved solids	mg	500
	Other Nitrogen	mg	3
	Chlorinated organics	mg	10
	Sulphate ions	mg	4300
	Sodium ions	mg	2300
Solid Waste	Industrial waste	mg	1800
	Mineral waste	mg	66000
	Slags and ash	mg	47000

Annex 7.7

Raw material sources for Indian manufacturers of PVC[9]

Manufacturer	PVC capacity	Raw material
Reliance Industries Ltd (RIL)	290,000	Imported EDC
Indian Petrochemicals Ltd (IPCL)	205,000	Integrated
Finolex Industries Ltd (FIL)	130,000	Imported EDC
DCW	60,000	Imported VCM
SFC	33,000	Calcium carbide
Chemplast	48,000	Alcohol/imported EDC
NOCIL	24,000	Integrated EDC

Major producers of PVC[10, 11]

Company	Total production of PVC
Reliance	3 Lakh tonnes
Indian Petrochemicals limited	2.05 Lakh tonnes
Finolex	1.50 Lakh tonnes
Chemplast	60,000 tonnes
Shri Ram	33,000 tonnes
DCW	60,000 tonnes
NOCIL	27,000 tonnes

Annex 7.8

Capacity and production of dyes and dyestuff between 1991-92 to 1996-97[12]

('000 Tonnes)

Name of dye	1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	Inst. cap	Prod.	Inst. cap	Prod.	Inst. cap	Prod.	Inst. cap	Prod.	Inst. cap	Prod.	Inst. cap	Prod.
Azo Dyes	2.9	2.3	3.1	2.1	4.9	2.3	4.9	2.8	4.9	2.5	4.9	2.3
Acid Direct Dyes (Other than Azo)	1.3	0.5	1.4	0.4	1.0	0.4	1.0	0.4	1.0	0.4	1.0	0.9
Disperse dyes	2.5	1.1	2.7	1.8	3.5	1.3	3.5	3.0	3.5	3.4	3.5	3.8
Fast Colour bases	0.8	0.1	1.3	0.4	1.3	0.5	1.3	0.3	1.3	0.4	1.3	0.3
Ingrain dyes	0.3	0.08	0.3	0.08	0.3	0.06	0.3	0.06	0.3	0.06	0.3	0.3
Oil Souble (solvent dyes)	0.02	NEG	0.02	NEG	0.02	0.05	0.02	0.1	0.02	0.09	0.02	0.1
Optical whitening agents	0.4	0.4	0.5	0.9	1.4	1.0	1.4	1.0	1.4	1.0	1.4	1.0
Organic pigment colours	7.5	4.5	7.3	5.9	12.0	6.7	12.0	8.3	12.0	7.7	12.0	8.8
Pigment emulsion	4.9	2.2	3.5	3.0	6.3	5.1	6.3	4.5	6.3	4.2	6.3	4.0
Reactive dyes	4.5	3.9	4.5	4.3	6.6	4.3	6.6	3.9	6.6	4.5	7.6	4.4
Stabilised azoics	0.2	NEG	0.2	NEG	0.2	-	0.2	-	0.2	-	0.2	-
Sulphur dyes (sulphur black)	2.4	2.6	2.9	2.7	4.2	2.9	4.2	2.6	4.2	3.2	4.2	3.0
Vat dyes	1.1	1.2	1.1	2.0	2.5	1.0	2.5	2.4	2.5	2.4	2.5	2.3
Solubilised Vat dyes	0.3	0.1	0.3	0.1	0.3	0.09	0.3	0.1	0.3	0.1	0.3	0.08
Food colours	0.1	0.06	0.1	0.08	0.1	0.09	0.1	0.08	0.1	0.08	0.1	0.05
Napthols	1.0	0.6	1.2	0.9	1.9	1.3	1.9	1.2	1.9	1.2	1.9	0.8
Other dyes (including Acrylic Fibre)	2.3	1.5	2.5	NIL	2.3	-	2.3	-	2.3	-	7.4	5.3

Consumption projection of dyestuff[13]

Dyestuff consumption per capita (gm)	1970	1980	1990	2000
Textiles	22.8	34.8	44	52
Other	3.2	4.2	6	10
Total	26.0	39	50	52
Per cent change	-	+ 50	+ 28	+ 24
Total Consumption ('000 tonnes)	14.0	26.4	42	62
Per cent change	-	+ 89	+57	+ 48

Annex 7.9

Brands of different types of milk contaminated with pesticides[14]

	Volume (ml) In 500 ml pack	Alpha BHC (ppm)	Lindane (ppm)	Heptachlor (ppm)	DDT (ppm)
PFA Act	W&MR NLT 409 ml	NMT 0.05 ppm	NMT 0.01 ppm	NMT 0.05 ppm	NMT 1.25 ppm
BIS	NM	NM	NM	NM	NM
Toned					
Amul (Taaza)		Nil	0.001	Nil	Nil
Gayatri		0.013	Traces	Nil	0.72
Gokul		Nil		Nil	0.23
Kapoor (Taaza)		0.007	0.001	Nil	Nil
Royal (24 karats)		0.004	0.001	Nil	1.06
Smruddh		0.004	0.001	Nil	0.6
Shresth		0.003	Nil	Nil	0.34
Uttam		0.003	Nil	Nil	0.53
Standerdised milk					
Amul (Shakti)		0.002		0.003	0.45
Gayatri		0.011	Nil	Nil	0.53
Gokul		Nil	Nil	Nil	Nil
Kapoor		0.001	Traces	Nil	0.20
Royal 5%		Nil	0.001	Nil	0.43
Samruddh		0.004	0.001	Nil	Nil
Sardar		0.01	0.004	Nil	Nil
Shresth		Nil	0.005	Nil	Nil
Suvarna		0.003	Traces	Nil	0.78
Uttam		Nil	Nil	Nil	Nil
Whole milk					
Amul (Gold)		0.002	Nil	Nil	0.45
Gayatri		0.014	0.001	Nil	Nil
Gokul		Nil	0.003	Nil	Nil
Kapoor (Gold)		0.004	Nil	Nil	Nil
Royal 5%		Nil	Traces	Nil	Nil
Samruddh		0.017	0.001	Nil	Nil
Sardar		0.007	0.001	Nil	0.005
Shresth		0.009	0.001	Nil	Nil
Suvarna		0.006	0.001	Nil	0.82
Uttam (Gold)		0.005	Traces	Nil	0.59
Loose Buffalo milk					
Ambawadi Dairy		0.001	Nil	Nil	Nil
Ambica dairy		Nil	Nil	Nil	Nil

NMT - Not More Than, NM - Not Mentioned, NLT - Not Less Than, W&MR - Weights and Measures Rules

Insecticide residues in milk and milk products (Annotated)[15]

Sample	Location	No. of samples		Insecticide	Range of residues (ppm)	Reference
		Analysed	Contaminated			
Milk	Delhi	17	13	DDT	0.02-0.75	Agnihotri et al., 1974b
	Ludhiana	60	60	DDT	0.01-1.08	Dhaliwal & Kalra 1977
	Delhi	14	13	DDT	0.05-2.00	Agnihotri et al., 1974
	Moga	406	406	DDT BHC	0.19-27.0 0.35-13.00	Sindhu, 1979
	Hyderabad	127	106	DDT BHC Endrin	tr-5.0 tr- 5.0 0.02-1.5	Lakshminarayana., 1980
	Bombay	43	24	DDT Dieldrin	2.8-10.8 1.9-6.3	Khandekar et al., 1981
	Parbhani	62	35	DDT BHC	0.01-1.75 tr-0.47	Jadhav, 1986
Cow milk	Parbhani	117	36	DDT BHC	tr-1.41 tr-0.22	Jadhav., 1986
	Ludhiana & Sangur	112	112	DDT BHC	tr-0.91 tr-6.04	Singh et al., 1986
Human milk	Ludhiana	75	75	DDT BHC	0.04-2.35 0.01-0.82	Kalra & Chawla., 1981
	Parbhani	254	254	DDT BHC	0.01-1.56 tr-0.21	Jadhav, 1986
Ghee	Punjab	5	5	DDT BHC	2.53-4.87 0.30-6.40	Kalra & Chawla., 1981
Butter	Delhi	8	8	DDT	1.10-8.0	Agnihotri et al., 1974b
Samples from various parts of India		105	105	DDT BHC	tr-16.14 0.02-11.97	Kalra & Chawla., 1981

Insecticide residues in meat, fish and eggs[16]

Sample	Location	No. of samples		Insecticide	Range of residues (ppm)	Reference
		Analysed	Contaminated			
Goat Meat	Delhi	10	10	DDT	0.5-1.6	Sharma et al., 1979
	Punjab	5	5	DDT	0.01-0.05	Kalra & Chawla 1983
	Ludhiana	7	7	DDT BHC	tr-0.22 tr-0.50	Battu et al., 1984
	Parbhani	47	18	DDT BHC	tr-5.1 tr-2.9	Jadhav. 1986
Sheep	Ludhiana	5	5	DDT BHC	tr-0.50 tr-0.02	Battu et al., 1984
Chicken	Ludhiana	6	6	DDT BHC	tr -0.29 0.01-0.18	Battu et al., 1984
Cow/Buffalo	Hyderabad	18	3	DDT	tr-0.15	Lakshinarayana Menon., 1970
	Parbahni	33	18	DDT BHC	0.03-4.1 tr - 2.1	Jadhav 1986
Pork	Ludhiana	7	7	DDT	0.19-1.3	Battu et al., 1984
Fish	Ludhiana	31	31	DDT BHC	0.02-3.02 0.01-1.12	Battu et al., 1984
	Bombay	14	7	DDT	0.43-34.05	Bhinge & Banerji
	Calcutta	53	27	DDT	0.02-0.21	Joshi 1986
Eggs	Pantnagar	6	6	DDT	0.02-0.04	Tripathi 1986
	Hyderabad	15	7	DDT	0.05-0.07	Lakshinarayana Menon., 1970
	Delhi	22	9	DDT	0.06-0.40	Agnihotri et al 1978
	Ludhiana	33	9	DDT	0.03-0.97	Kalra & Chawla 1983
	Bombay	37	30	DDT BHC Linadane Heptachlor Aldrin Dieldrin	0.47-2.1 0.01-1.01 0.01-0.78 0.04-0.06 0.08-0.10 0.12-2.5	Kalra & Chawla 1983 Kalra & Chawla 1983 Kalra & Chawla 1983 Kalra & Chawla 1983 Kalra & Chawla 1983 Kalra & Chawla 1983

MRL values of Pesticides on Food Commodities [17]

Name of pesticide	Food	Maximum Residue Limit (mg/Kg)
Aldrin, dieldrin	Food grains	0.01
	Milk and Milk products	0.15
	Fruits and vegetables	0.1
	Meat	0.2
	Eggs	0.1
Chlordane	Food grains	0.05
	Milk and Milk products	0.05
	Vegetables	0.2
	Fruits	0.1
	Sugar beet	0.3
DDT	Milk and milk products	1.25
	Fruits and vegetables	3.5
	Meat, poultry and fish	7
	Eggs	0.5
Heptachlor	Food grains	0.01
	Milled food grains	0.002
	Milk and milk products	0.15
	Vegetables	0.055
Hexachlorocyclohexane (alpha isomer)	Rice grain unpolished	0.10
	Rice grain polished	0.05
	Milk whole	0.05
Hexachlorocyclohexane (Beta isomer)	Rice grain unpolished	0.10
	Rice grain polished	0.5
	Milk whole	0.02
Hexachlorocyclohexane (Gamma isomer)	Food grains except rice	0.10
	Milled food grains	Nil
	Rice grain unpolished	0.10
	Rice grain polished	0.05
	Milk whole	0.01
	Milk products	0.20
	Fruits and vegetables	3.00
	Egg (shell free)	0.10

Annex 7.10

Bioenvironmental Control Strategy

The WHO (1980) gave the following definition of environmental management methods in vector control "The planning organization, carrying out and monitoring of activities for the modification and/or manipulation of environmental factors or their interaction with a view to preventing and minimizing vector propagation and reducing man-vector-pathogen contact. Environmental management for mosquito control covers a wide range of works and operations which can be further classified:

Environmental modifications: "A form of environmental management consisting in any physical transformation that is permanent and long lasting of land, water and vegetation, aimed at preventing, eliminating or reducing the habitats of vectors without unduly adverse effect on the human environment". Environmental modification includes drainage, filling, land levelling and transformation and impoundment's of boundaries. Although these works are of permanent nature, proper operation and adequate maintenance are essential for their effective functioning.

Environmental manipulation: "A form of environment management consisting in any planned recurrent activity aimed at producing temporary conditions unfavourable to breeding of vectors in their habitats." Water salinity changes, stream flushing, regulation of the water level in reservoirs, de-watering or flooding of swamps or boggy areas, vegetation removal, shading and exposure to sunlight are some examples of the environmental manipulations.

Modification or manipulation of human habitation or behaviour: "A form of environmental management that reduces man-vector-pathogen contact." Like siting of settlements away from the vector sources, mosquito proofing of the houses, personal protection and hygiene measures.

Biological control methods: A number of biological control measures are applied to control mosquito breeding, viz. fishes, bugs, meso-cyclops, larvicides, fungi, etc.

Early case detection and prompt radical treatment: Bioenvironmental methods do not reduce the longevity of mosquitoes and therefore, transmission may take place even through low vector populations. It is therefore important to reduce the parasite load from the community by developing a first rate surveillance system.

Health education: Communities should be fully informed of the serious nature of the malaria and its causes and effect relationship, and how community can help control mosquito breeding and malaria.

Community participation: Communities should be involved in all activities of vector control from the very beginning. They should be encouraged to participate on regular basis and in the process they become the partners in various activities.

Intersectoral co-ordination: In many rural or urban areas, various departments /agencies are involved in developmental works. There should be proper coordination among agencies like irrigation, health and public works departments.

Economic incentive linked schemes: To make the programme sustainable and peoples friendly, efforts should be made to introduce income-generating schemes. The measures used like biological control should be labour incentive.

Insecticide use: The insecticides should be held in reserve to tackle epidemics or situation not amenable to bio-environmental control methods.

Personal protection methods: In some mosquito prone areas it may not be possible to control malaria either by bioenvironmental methods or by spraying the residual insecticides. In such cases the used of bed nets can be promoted.

Annex 7.11

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